COMPUTER
HOME SOFTWARE

**Creative Strategies
International**

Computer Software
Industry Analysis Service

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Creative Strategies International

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Industry in Brief

Recently, the personal computer market has undergone a dramatic shift in emphasis from being hardware intensive to software intensive. Most industry observers agree that for the personal computer market to realize its full potential, falling hardware costs must be complemented by increased availability of quality, user-friendliness, cost-efficient applications, and systems software.

INDUSTRY

One of the fastest-growing areas of personal computer use is the home market. In 1982, over 2 million personal computers were sold for home use in the United States. To complement these and previously installed home systems, almost 4 million packages of home software were sold.

Home software is defined as software products manufactured or available for personal computers that are used primarily by family members in a nonbusiness or home environment. Applications include:

* Entertainment
* Education

* Home management (finance and business)
* Other (information services, home monitoring)

Entertainment is basically games oriented; however, application software for music systhesis and graphic art drawing also fits within this category. Home management packages are presently in the form of home budgeting, investment tracking, and mortgage amortization. Low-priced business applications packages are also available for home usage in the areas of word processing, financial models, and database management. Education software is for personal learning and skill development designed for a variety of age levels and tasks. The "other" category includes information systems such as videotex and databases and home monitoring software for environmental control in the home.

The primary language used by personal computers for home applications is BASIC. Simpler languages such as PILOT and LOGO, although designed primarily for children, are increasingly being used by all age levels.

The current major suppliers of computer home software are hardware vendors who produce or license software from outside and independent software companies. Enterpreneurs and publishing houses are minor vendors. Current vendors will be challenged in the near future by large companies such as movie manufacturers, video game makers, and Japanese hardware and software suppliers as competition in the computer home software market increases. Forward-looking strategies will need to be created and implemented for present vendors to retain a significant market share. Strategy planners should consider:

* Assessment of distribution channels
* Buyer awareness and demands
* Technological innovations
* Socio-political trends
* Present and future competition

MARKET

The computer home software market offers:

* High risk and high potential return on investment

* Marginal barriers to entry

* Lack of industry-produced standards

* Shortage of quality people to program computer home software packages

As the demand for personal home computers increases, so too increases the demand for computer home software. In the United States in 1982 there were over 2.5 million personal computers in the home; in 1987 13 million units are expected to be in active use in the United States, accounting for 15 to 20 percent of all U.S. families.

U.S. computer home software shipments in 1982 totaled 3.986 million units. This shipment number is expected to grow at 78 percent per year through 1987. U.S. international annual shipments and revenues for each year are detailed in the Market chapter. Revenue projections are also provided for the four computer home software application segments.

In 1982, about 53 percent of revenues were from entertainment software, 22 percent home management, 20 percent education, and 5 percent other. Rapid growth is expected in all segments during the forecast period, but market shares will change.

In 1982, about 42 percent of the computer home software revenues were from cartridge sales, a comparable amount from cassettes, and about half that from disks. These percentages will change drastically in 1987 when disk and cartridge sales will dominate the computer home software market. Again, the Market chapter provides year-by-year projections.

TECHNOLOGY

Powerful applications software, increasing processing capabilities, and declining hardware costs are the major factors behind the growth of the microcomputer industry. The ability of companies to develop applications software that satisfies the needs of business and home has generated a large demand for microcomputers.

A symbiotic relationship exists between hardware and software in microcomputers today. As new hardware evolves, software must be designed to take full advantage of the new hardware capabilities. Similarly, as demands for more powerful software grow in the marketplace, sufficiently advanced hardware must be designed and manufactured

Significant advances have been made in the past 4 years in microprocessors, semiconductor memory, and floppy and hard disk storage technologies. Continuing performance improvements can be expected that in the area of computer home software will:

* Lower the price of a program

* Lower the price of a disk drive, so more consumers will be able to purchase a drive and uses computer home software disk programs

* Allow more information or game capability to be stored on a program

Other technologies especially influencing the computer home software market are:

* Interfaces, such as the "mouse," that simplifies some system command operations; or emulators that can let a hardware system run software made for noncompatible machines.

* Languages, such as PILOT and LOGO, which make hardware system operation more "user friendly" and can program graphics.

* Operating systems, by adding easier commands or more powerful functions, that simplify machine operation.

* Technological breakthroughs, in areas such as vector graphics, raster scanners, videodisks, and holographs, that will enhance home software packages and make especially game playing "true to life."

COMPETITION

Competition in the computer home software market is growing fierce. Prior to 1982, most home software was provided by hardware vendors for their respective systems, who either had the software designed internally or licensed from outside. In late 1981-1982, as the shipments of computers for home use increased, many small entrepreneurial software firms entered the growing market. Some of these are already succeeding in acquiring sales revenues of several millions of dollars. In 1982 wholesale home software revenues

were divided at about 39 percent for hardware companies who produced or licensed software and 61 percent for independent software companies. Key hardware suppliers include: Apple, Atari, Commodore, TI, and Radio Shack. Leading software companies include: Sierra On-Line Systems, Sirius, Broderbund, Continental Software, and Automated Simulations/ Epyx. Although most key independent software vendors provide entertainment software, home management software companies (and to a lesser degree educational software companies) will increase in company revenues during the forcast period.

Industry

The personal computer market has recently undergone a dramatic shift in emphasis from being hardware intensive to software intensive. Most industry observers agree that for the personal computer market to realize its full potential, falling hardware costs must be complemented by increased availability of quality, user-friendliness, cost-efficient applications, and systems software.

One of the fastest-growing areas of personal computer use is the home market. In 1981 about 800,000 personal computers had been sold in the United States. Only about 25 percent of these systems had been sold primarily for home applications. In 1982 over 2.5 million personal computers specifically for home use were shipped. As systems cost decreases and consumer computer awareness and literacy increase, an increase in the purchasing of personal computers for home usage will occur. Optimistically, by 1990, over 10 million personal computers could be sold yearly for the home. To complement these systems will be a plethora of software for entertainment, education, home management and monitoring, and information services. These products will be provided by a vast variety of software vendors ranging from software companies to publishing houses; from hardware manufacturers to cable TV.

SCOPE AND DEFINITIONS

Software is fundamentally the instructions that constitute the intelligence of the computer. Historically, software has been divided into two distinct sectors -- systems software and applications software; however, the delineation has become increasingly blurred.

Systems software is normally included in the user's initial cost of the computer and is developed by the hardware vendor or an independent software systems house, purchased by the hardware vendor and incorporated in the machine. It is this software that manages all the computer's resources and supervises the processing of the end-user's program.

Application software packages, on the other hand, are designed to supply solutions to specific end-user needs. Examples of applications programs include word processing programs, games, spreadsheet analysis, and education, to name but a few.

This study is designed to investigate the computer home software (CHS) market primarily from the prospective of application software while also including personal computer systems software present products and trends. The current industry structure as well as the potential forces influencing industrial change will be assessed.

Home software is defined as software products manufactured or available for personal computers that are used primarily by family members in a nonbusiness or home environment. Applications include:

* Entertainment
* Education
* Home management (finance and business)
* Other, which includes home monitoring and information retrieval services

Excluded from this definition are:

* Video game systems and available cartridges for such products
* Programmable calculators and available software
* Business applications packages costing over $75
* Specific business and scientific languages and operating systems

* Dumb terminals
* Handheld computers and available software

Figure 1 shows where computer home software fits within the "family tree" of applications and types of software.

The term personal computer as used in this study is a subset of the microcomputer market. About 65 percent of microcomputers are also personal computers. A microcomputer as defined by Creative Strategies International is as follows:

* The microcomputer system must include, at minimum, a microprocessor, semiconductor memory, power supply, mainframe cabinet, operating software, and electronic components that allow input and output of information

* The system must be programmable by the end user in at least one high-level language

* The system must be operable in a standalone mode

* One microprocessor must handle the traditional central processor unit (CPU) computational functions

* The end-user price of the system in the form sold by the manufacturer, whether meeting or exceeding the above minimum product requirements, must be less than $15,000

The personal computer has all the above qualifications and is generally priced under $3000 -- average unit price in 1982 was $425. It is also generally used by a single user or family rather than a group of employees. The term personal computer is therefore a nebulous term used primarily for marketing purposes.

The lines between small business computers (SBCs), very small business computers (VSBCs), microcomputers, and video games upgradable to computers all tend to slightly overlap. This occurrence is best described pictorally in Figure 2. Where the definitional overlap does occur, the system could be defined by either or both labels.

FIGURE 1
MICROCOMPUTER SOFTWARE MARKET
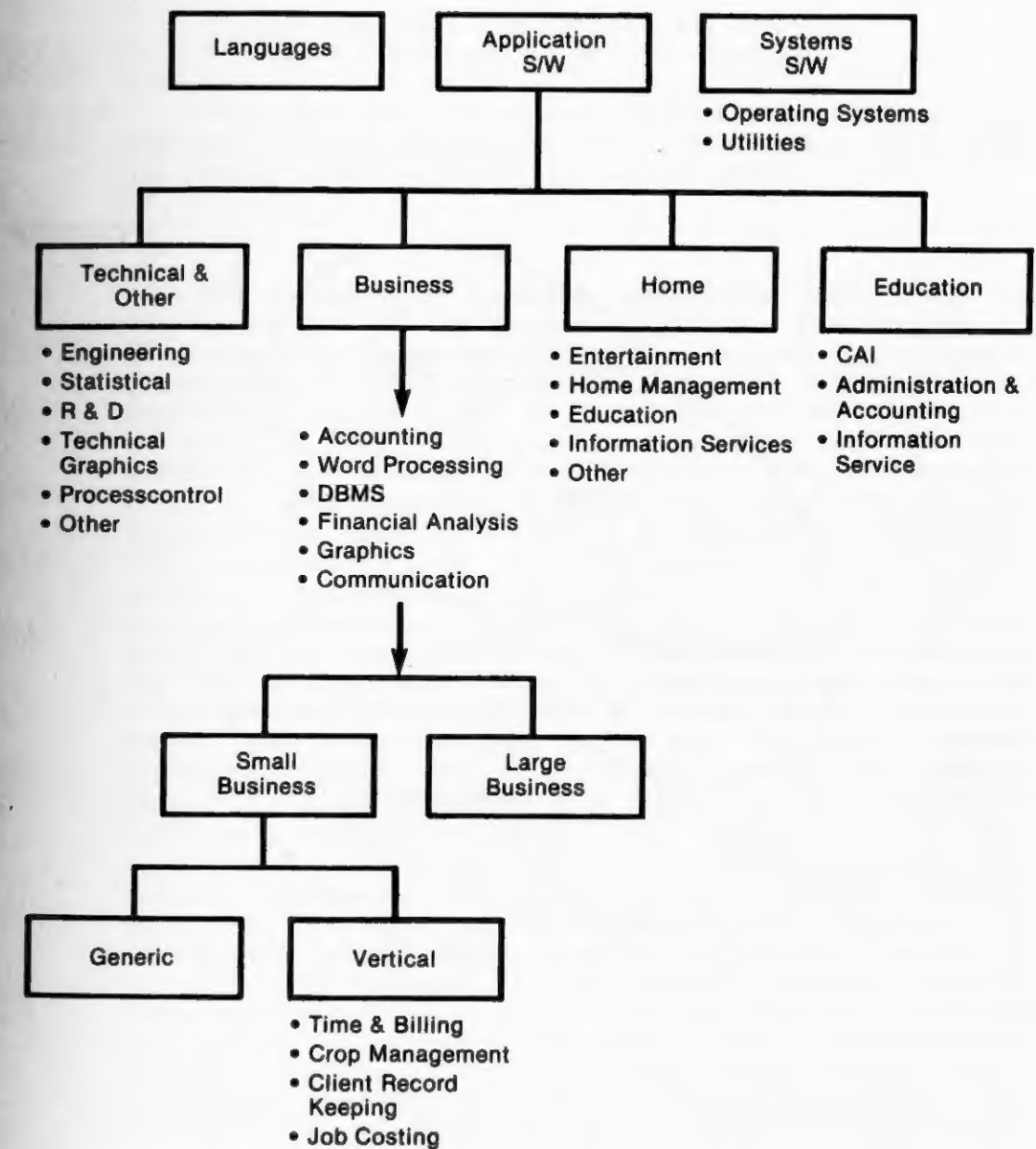
Source: Creative Strategies International

FIGURE 2
INTERRELATIONSHIP OF
COMPUTER SYSTEMS
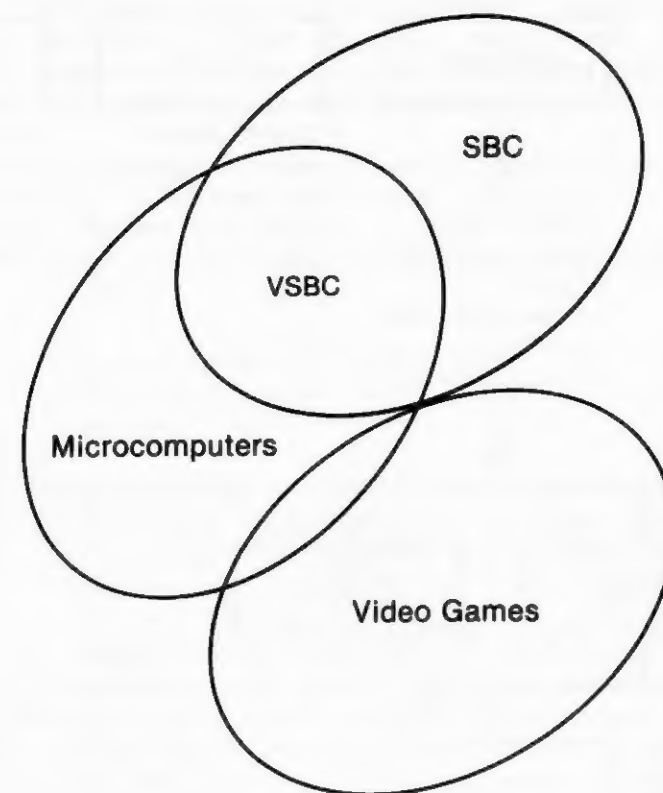
Source: Creative Strategies International

The home computer market is often considered synonymous with the personal computer market. This study will consider the home computer market to be a subsegment of the personal computer market since presently most home systems:

* Cost less than $300 for the base unit
* Utilize a standard home TV for output

The Atari 400, Commodore VIC-20, Radio Shack Color Computer, Texas Instruments 99/4A, and Sinclair ZX-81 were the leading home computer products in 1982.

HISTORY

The evolution of consumer electronics led the way for the acceptance of the personal computer. (See Figure 3.) Beginning with the phonograph in 1880, and growing with radio broadcasting in 1920 and television in 1946, electronics was becoming a standard part of American life. With integrated circuitry in 1966, the pocket calculator and electronic watch became personal tools of everyday life. A few years later, a major electronic development occurred that initially impacted the business world but is increasingly infiltrating the consumer arena. Microprocessors, tiny electronic computers engraved on a silicon chip, were first developed in 1971 by semiconductor manufacturer Intel. Business computers could then be made with immense capabilities at a fraction of the size of previous systems. For consumer electronics, the microprocessor translated into TV video games, microwave ovens, and crude personal computers. The early personal computers usually had design flaws, offered no software support, and were inoperable by anyone without a degree in electrical engineering. They were offered in kit form primarily via mail-order channels. Peripherals such as video display, keyboard, and mass storage required separate purchases. However, the availability of these computer kits, priced well under $1000, initiated a growing interest in computers for hobbyists. In 1977 market demands changed. Consumers with little or no engineering experience expressed an interest in personal computers. Thus, preassembled, pretested systems entered the market. Radio Shack, Apple, Commodore, and Ohio Scientific all began marketing personal computer systems. Since the home user also wanted software support, fully integrated software language in ROM modules were offered. Market demand was quickly shifting toward simplification and system support even though most personal computer users were still hobbyists. About this time the

FIGURE 3
EVOLUTION OF CONSUMER ELECTRONICS

Consumer Electronics		**Business Electronics**	
1880	Phonograph		
1920	Radio Broadcasting		
1946	TV		
	HI-FI Hobby		
	Tape Recorder		
1954	Consumer Transistor Radio	1950s	Large Mainframe Computers for Business Uses
1964-66	Color TV Boom		
	Cassette & 8-Track Tapes	1969	IBM Unbundles S/W
	Integrated Circuitry		

──────────────── 1971 Microprocessor ────────────────

1972	TV Video Game	1972	VSBC
1975	VCR	1973-77	Personal Computer
	Microwave Ovens		
		1979	S/W Packages
1980	Home Computer & CHS		ROM Systems S/W
			Standard OS

Source: Creative Strategies International

first computer store opened to provide retail sales, support, and software.

From 1979 to 1980, the personal computer was still a hobby and/or business tool, but due primarily to the evolving consumer electronics industry and the popularization of VCR and video game systems, the demand for home application software for personal computers began to evolve. With a video game system, interaction by families with a keypad (system console), monitor (home TV), and software (preprogrammed game cartridges) lessened the fear of computers for a large segment of the population. In 1982, almost 20 percent of homes in the United States that a TV set had also had a game console. In 1981, 4.5 million home game systems were sold in the United States -- a 125 percent increase over 1980; in 1982 over 8 million were sold. An average of eight software cartridges is bought over time to complement each system. At about $25 average unit price per cartridge, that amounts to a very lucrative video game software market.

With the increasing acceptance of personal computers for home use, there will also be an increasing demand for computer home software, creating a very large market potential for home software vendors.

APPLICATIONS

The primary computer home software applications are:

* Entertainment is basically games oriented; however, application software for music synthesis and graphic art drawing also fits within this category. Games can be divided into three subsegments: arcade games, strategy games, and adventure games. Arcade games are similar in content to the large standalone computer games one would play in a bus station, diner, or arcade. For home usage, the software package simply needs to be inserted into the personal computer, a paddle or "stick" peripheral attached to the main system component, and the game begun. Arcade games are basically self-explanatory -- no instructions are needed. A strategy game is somewhat more sophisticated. Each player is provided with statistics (e.g., in a baseball strategy game past world series scores, strategies, and statistics may be given). Each

player is then free to choose which course of action to implement in order to outdo a fellow player or past statistics. In adventure games (or fantasy games) a player is taken on an unknown trip and has to decide which turn in the road or what mode of action to employ in order to succeed in the game's object. For example, in a catch-the-spy game, a player may choose from among many different opportunities (get on a bus, don't get on a bus; talk to a person, don't talk to a person) in order to "catch the spy." Due to the sophistication of the latter two types of games, most are found only on diskette -- not the other home software mediums such as cartridge and cassette.

* Education is another small yet growing market for computer home software. Most present educational packages are no more than a textbook on a screen, with little creativity added, thereby producing a less-than-stimulating learning environment. Newer evolving computer home software packages are turning education into fun by intertwining games with learning and providing supportive verbal or tonal feedback. As more parents purchase computers for their children to aid their educational growth and development, the demand for innovative educational computer home software will increase.

* Home management (business and financial) software is on a gradual increase. Presently, most packages are in the forms of home budgeting, investment tracking, and mortgage amortization. Low-priced business applications packages are also available for home usage in the areas of word processing, financial models, and database management. These packages, however, are much less sophisticated than business packages for the same applications.

The minor computer home software applications include the following:

* Home monitoring, a newly discovered home software application for the personal computer. Several systems now exist that allow a personal or home computer to run appliances, control security devices, and operate home lighting. However, these must be attached to an interface for analog-digital conversion to be able to function on a personal computer. In 1982, the inexpensive manually controlled home device for the same processes is more cost effective, but as new home software products are developed, this situation may change.

* Information retrieval systems are available by subscription to the user, providing access to large information banks. Interactive systems are generally referred to as "videotex." These systems generally link terminals or microcomputers, either by cable or telephone lines, to large databases. By properly instructing the terminal or microcomputer, the user gains access to the desired information. News, financial markets information, banking information, weather conditions, airline, railroad and bus schedules, and many other types of information can be obtained from such systems. It is expected that consumers would be willing to subscribe to electronic banking services if successfully implemented on such a system. Once a user base is established, further services (e.g., shopping at home) could be offered. It is expected that information systems could significantly expand the market for microcomputers.

HARDWARE SYSTEMS

Hardware systems for home software can be divided into two categories -- low end and high end. A low-end product:

* Costs under $700
* Interfaces to a home TV for output
* Has 16,000 or less RAM in the basic configuration (even though expansion capability may be present)

Major products include: Atari 400 and 800, Commodore VIC-20 and 64, Radio Shack Color Computer, Sinclair ZX-81, and TI 99/4A. Table 1 lists major system characteristics.

TABLE 1

MAJOR LOW-END HARDWARE SYSTEMS THAT UTILIZE HOME SOFTWARE

Vendor	Product	Microprocessor	Operating System	User RAM	Expansion Capability	External Storage	Price
Atari	400	8-bit, 6502B	Atari	4K	32K	cassette	<$300
	800	8-bit, 6502	Atari	16K	48K	cassette, disk	<$700
Commodore	VIC 20	8-bit, 6502A	Commodore	5K	32K	cassette, disk	<$300
	64	8-bit, 6510	Commodore	64K	—	cassette, disk	$595
Radio Shack	color computer	8-bit, 6809E	color TRS DOS	4K	32K	cassette	<$300
Sinclair	ZX81	8-bit, Z80A	custom	1K	16K	cassette	<$100
Texas Instruments	99/4A	16-bit TMS9900	custom	16K	48K	cassette, disk	<$300

Source: Creative Strategies International

The Commodore 64 which just began shipment at year-end 1982 also fits within the low-end segment in Table 1, but shipments as well as home software offerings for the product in 1982 were not significant.

High-end hardware systems cost between $800 and $2500, and are generally configured as a package including a keyboard computer, extra monitor, and disk drive. Major products are Apple II, Radio Shack I and III, and Commodore PET. The IBM Personal Computer, although not a major force in the home market presently, will be considered a significant part of the high-end segment by 1984, when system price drops and home application software grows for the newly evolving 16-bit machines. Presently, home software for the IBM Personal Computer is limited. See Table 2 for major high-end system characteristics.

LANGUAGES

The primary language used by personal computers for home applications is BASIC. Simpler languages, such as PILOT and LOGO, are increasingly being used, especially with children.

LOGO was developed by a MIT professor in the 1970s. It is a unique kind of programming language in that it allows young children to communicate with a computer, and to draw and color images with "Turtle" graphics, all with a set of simplistic instructions. The LOGO language has been available for the TI 99/4 and 99/4A for several years and as of June 1982 is being manufactured for the Apple II. LOGO is considered by many industry watchers to be the computer language of the future, especially for computer novices, young and old alike. It has been said that LOGO will replace BASIC as the number-one language in home/school computers by 1987.

Pilot is the second new home and educational language. It is available for Atari and Apple computers and, as LOGO, has "Turtle" graphic functions and simplistic computer instructions. The main difference between PILOG and LOGO is that PILOT is said to be a teaching language (designed to create educational programs), while LOGO is a learning language. In the long run, this distinction will become quite vague. Both languages are excellent computer languages for beginners.

MAJOR HIGH-END HARDWARE SYSTEMS THAT UTILIZE HOME SOFTWARE

Vendor	Product	Microprocessor	Operating System	User RAM	Expansion Capability	External Storage	Price
Apple	II	8-bit, 6502	DOS 3.3	16K	64K	cassette, disk	$1700
Radio Shack	I	8-bit, 280	TRS DOS	discontinued		cassette, disk	$ 700
Radio Shack	III			4K	48K		
Commodore	Pet	8-bit, 6502	Commodore	32K	—	cassette, disk	$ 800
IBM	PC	16-bit, 8088	MS DOS; CPM/86 p-system	16K	256K	cassette, disk	$2400

Source: Creative Strategies International

SOFTWARE MEDIUM

Home software for personal computers comes in four different mediums -- the cartridge, cassette, diskette, and phone downloading (either from an information service or private supplier). The cartridge is the simplest software medium for the end user. It can be accessed by simple insertion into the personal computer -- no additional peripheral attachment is necessary. However, to use a cassette, disk, or to download permanently for future utilization, either a recorder or disk attachment is necessary. (For phone downloading even for nonpermanent software retention, a modem is a required peripheral.) Cassette recorders cost around $75; single disk drives run from $400 to $500.

Most low-end products are purchased with either no storage device or with a cassette recorder. For cheaper low-end systems (such as Sinclair), a disk attachment is not an option which creates a problem for a developing end user. If an end user is at the computer literate stage where a greater system capacity and function to perform applications is needed, he/she must then "trade up" to a higher quality and more costly system to increase capacity -- a potentially expensive remedy. As a home personal computer user becomes increasingly sophisticated, even cassette storage no longer remains adequate, and the diskette medium becomes the only viable choice. (See the Technology chapter regarding mass storage for additional storage information.)

CURRENT INDUSTRY STRUCTURE

Relating a company to its environment is the key to forming a competitive strategy. Although many social and economic forces interact within any environment, the key entity for a company to note is the industry or industries in which it competes. Present industry structure for computer home software will be discussed in this segment of the study. This will include present competing firms and the interrelationship between them, and the other four driving forces of industry competition: buyers, suppliers, substitutes, and threat of potential entrants. Future trends influencing these forces (and therefore the computer home software market as a whole) will be discussed in the section "Industrial Structural Changes."

A strategist should delve below the surface and analyze the competitive pressures -- present and potential --

relating them to the overall strength and weaknesses of his/her respective company. By doing so, market areas that appear to yield the highest return for investment can be pursued, while areas that present the largest threats or barriers can be avoided.

Current Suppliers

Current home software suppliers include hardware vendors, software companies, publishing houses, information networks, and entrepreneurs. Entrepreneurs either act as suppliers to one or more of the other four segments, or market their products themselves. Even though the home software market remains in its infancy, established leaders have emerged.

Presently hardware manufacturers that produce computer home software independent software companies with sales revenue in excess of $500,000 per year supply most computer home software, accounting for approximately 80 percent of computer home software revenue. As microcomputer systems designs became standardized, prices decreased while capabilities increased; thus the key to market success became software. Initially, software was business oriented, but as systems decreased to below the $1000 level and consumer computer awareness grew, computer home software packages were marketed.

Apple, by far, has the largest amount of major advertised software (much available for the home), but Radio Shack and Commodore both have large numbers of entrepreneurs who supply software, as well as many packages that are produced internally or licensed to the vendors. Over a thousand games, educational packages, and home management programs are available for each vendors systems. Texas Instruments and Commodore have more education-oriented software packages since both manufacturers had initially geared their product marketing to the educational environment. Since Atari's name recognition evolved from its VCS, most initial software for Atari 400 and 800 machines remained entertainment oriented. Atari, however, is now attempting to switch its "game-maker" image to a more professional one. To aid this change, the company is adapting more home management and educational software for its products as well as advertising networking capability via modem attachment.

Microcomputer manufacturers have hesitated to develop transferable software, due to the large investment required and the boost it would provide competitors. As a result, when a manufacturer believes it is necessary to provide a specific type of software for its products, it generally contracts with an independent firm to develop such software, or arranges with a software supplier to provide already-existing compatible software.

All major personal computer vendors of computer home software have established programs to encourage individuals to create their own software. Apple advertises a kit for qualified participants that provides all the special tools and documentation needed to develop quality software for its products. Atari has several special software acquisition facilities located across the United States, where Atari and competitor machines can be utilized for either developing new software, or adapting a competitor's software product to work on an Atari machine. A $100,000 contest for software authors is also being offered by Atari. Radio Shack, TI, and Commodore, perhaps somewhat to lesser extents, are all making overt attempts to encourage new software development.

Most of the quality business software available today comes from software companies, the second major computer home software vendor. This trend will continue as software companies become a major marketing force for hardware. The most successful software firms in the business applications area are growing at an average rate of 12 percent per month.

Independent software companies are also offering other computer home software applications. Most of these companies, such as Sierra On-Line, Automated Simulations/Epyx, Broderbund, Sirius Software, are entertainment oriented. In spite of the fact that the majority of independent software companies have only been market participants for one to two years, yearly sales for many total in the millions of dollars. Usually the inspiration for such companies originated with a young computer enthusiast who, either through chance or intention, created a unique computer game, (e.g., Nasir Gebelli's "Gorgon," and James Nitchal's "Asteroid Field"). Rather than selling the game to a major hardware vendor, these software entrepreneurs chose to form their own companies to market their games. Due to the marginal barriers to entry for computer home software, and large demand for entertainment packages, the number of these small companies rose in 1982 and success stories abounded.

Publishing houses, such as McGraw Hill, Prentice Hall, and CBS Publishing, have begun marketing computer home software as well. Generally, these vendors concentrate their products in the educational and self-improvement areas. Reader's Digest also owns "The Source," a major home and business information service located in McLeans, Virginia, and is actively soliciting educational software packages to market.

The Source, MicroNET, CompuServe, and the Dow-Jones News Retrieval Service serve as the main distributors of information services for personal computers. Informational data banks can be accessed from these networks, and, to a lesser extent, entertainment and educational software programs as well. An initial entry fee (of about $100) to provide a user membership is one of these services. Time spent directly accessing data is charged to the subscriber, usually on an hourly basis. As previously mentioned, a modem is a necessary terminal or computer peripheral to access an information service. The additional software that is necessary for accessing a database is generally available through hardware vendors and costs range from $100 to $125 per communications package.

All major networks except CompuServe are supported strongly by Apple, Atari, Commodore, and Radio Shack. The CompuServe database is offered only through Radio Shack stores and thus draws the bulk of the TRS-80 users.

Entrepreneurs are the final category of computer home software vendors. Once they have designed a computer home software package, they have four options:

* Sell the package outright to hardware vendors, software companies, or publishers (e.g., information services)

* Sell (or lease) their package to the channels named above for royalties

* Market the product themselves via mail order, advertising in computer magazines

* Form their own software company

Each choice has its advantages and disadvantages. Although presenting an immediate financial return, selling outright prove to be shortsighted if the product goes on to

enjoy a huge success. When selling products, established hardware firms offer lower margins but also lower risks. For entrepreneurs, royalties can run from 20 to 40 percent (or $3.00 to $4.50) for a computer home software product sold at wholesale for $15. A "hot" product (generally a game) might sell 25,000 to 40,000 copies, making $75,000 to $150,000 for the game designer. Conversely, the product may prove to be less than a success, whereby royalties would prove minimal. Individual product marketing by mail order demands little investment, but usually generates little return. Forming a company requires greater investment (capital and talent) -- a worthy risk for those fortunate enough to succeed.

DISTRIBUTION CHANNELS

The distribution channels mentioned for computer home software by the hardware vendors are similar to major microcomputer channels. (See Figure 4.)

Because microcomputers are relatively low priced, and are often sold one at a time, manufacturers are usually unable to justify direct sales forces. As a result, manufacturers commonly use distributors. The larger companies often establish their own distribution networks.

Computer Retail Stores

These stores account for approximately 50 percent of all microcomputer sales (when combined with specialized electronics stores). Computer retail stores are defined as those stores that derive most of their revenues from computer products. Although some stores are specifically business oriented, most are designed to serve a broad cross-section of consumer, business, and educational users. Computer retail stores fall into two broad classifications: (1) those owned by computer manufacturers (e.g., Radio Shack, Digital Equipment, IBM, or Xerox), and (2) independent outlets. Most computer stores offer some sort of service and warranty support.

U.S. Distributors

Distributors constitute the major means of intermediate distribution throughout the United States. They usually have better financing than computer retail stores, therefore dealing in larger quantities of merchandise. They offer stores the opportunity to deal with a single source, and provide more rapid delivery than most manufacturers can

FIGURE 4
CHANNELS OF DISTRIBUTION
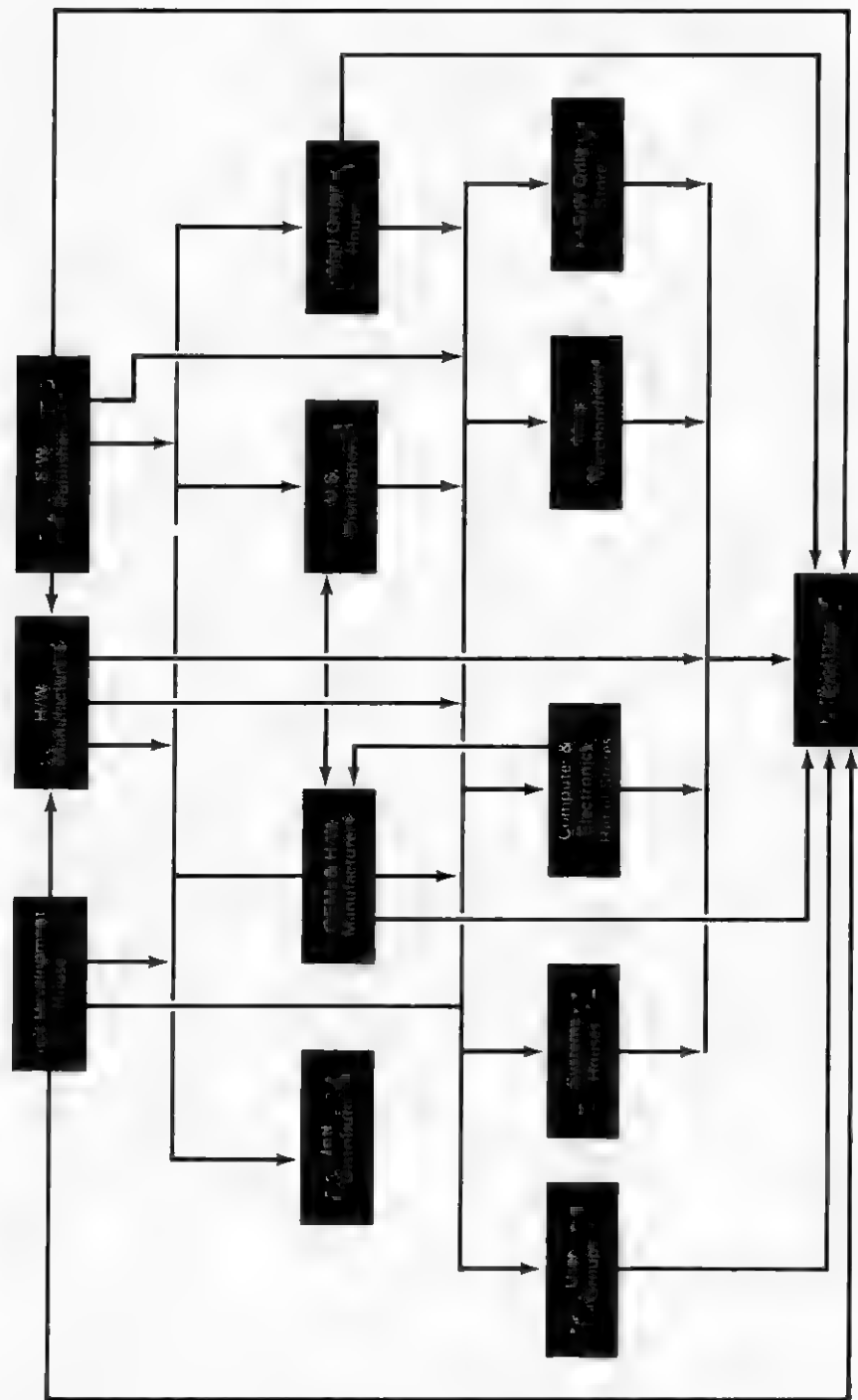
Source: Creative Strategies International

promise the retailer. The most notable national microcomputer distributors are MicroAge and Byte Industries. ComputerLand, a computer retail store franchise business, also provides ComputerLand stores with an exclusive central purchasing and distribution operation for those stores wishing to utilize it.

Tandy has also signed some 60 consumer electronics distributors to market its home computer to independent retailers, marking the first time the firm has attempted to sell a computer product outside its own Radio Shack chain.

Specialized Electronics Stores

These are consumer electronics stores that often carry a wide range of consumer-oriented products. Radio Shack dealers provide the best example. Stores in this group usually carry products with margins up to 50 percent. They are likely to have only minimal technical computer expertise and service capability.

Mass Merchandisers

Mass merchandisers are characterized by Sears, Macy's, and J.C. Penney, but this category also includes smaller chains or independent stores. Discount stores have also begun carrying home computers. K-Mart is carrying the TI 99/4A and Commodore VIC-20 in an increasing number of its stores, while Woolworth's Woolco division has been sampling Commodore, Atari, and TI home computers in its stores. Microcomputers are generally placed in the stationery, games, stereo, or consumer electronics departments of these stores. In return for a gross margin in excess of 40 percent, the merchandiser is expected to provide promotional services, merchandising services (including warranty), end-user advertising, and displays.

Mail Order

For software companies, the primary distribution channel, mainly for cost reasons, has been mail order, however, the larger companies distribute through software distributors (e.g., Softsel). Mail order leaves out all the necessary in-between channels from vendor to user, which in turn adds additional mark-ups on the wholesale price of the software (see the Market chapter for further elaboration on this point). Software vendors such as the Atari Program Exchange (APX) sell Atari software, many products from

independent software companies, and entrepreneurs, through a quarterly catalog with mail order coupons.

Software-only Stores

Software "supermarkets" and specialty stores are rapidly evolving. These stores are based on the concept of the record stores in the 1950s where selections could be played before purchasing. They allow their programs to be tried by the customer on one of the various computer systems before actual purchase. Time-dated moneyback guarantees on programs are also standard. This type of distribution channel provides the consumer with a much broader software selection than the software mail-order houses can offer.

Other Less-common Distribution Methods

Publishers have used their established national sales networks to distribute their software products. Mail order advertisements are being employed to supplement distribution efforts.

Information services are distributed primarily by phone lines; in some rare cases, cable TV.

Entrepreneurs can use distribution channels such as mail order, information services, publishers, hardware and software companies (and their related channels if the entrepreneur's product was being leased and marketed by a specific vendor), and the new software specialty stores.

OTHER INDUSTRY FORCES

Interaction among the aforementioned five types of computer home software vendors provides the major industrial force. The other four forces (buyer's power, supplier's power, substitutes, and threat of entry) will be elaborated on below.

Buyer's Power

As of yet, consumer buying power does not constitute a major force in the computer home software market, primarily due to the newness of the home market, and the subsequent lack of market and product awareness. As the market develops, however, buyers will be able to demand low-cost, user-friendly, easy-to-use hardware and software home products.

In relation to entrepreneurs, the hardware manufacturers, software companies, and publishers (as well as the general public) are considered "buyers." Since quality new home software is in such demand, major computer home software suppliers impose few pressures on entrepreneurs. Once a company discovers a qualified programmer, major companies spare no expense to keep the designer happy and productive.

Supplier's Power

The cost of manufacturing a product and delivering it, generally about 10 percent of revenue, constitutes the supplier force on a computer home software vendor. This includes the cost of an advertising agency (the advertising itself asks another 10 to 20 percent), cassette, cartridge, or diskette material, and the software program designer. Again, this is not a pressing force on vendors -- packaging costs are relatively constant and programmers are employed as individuals not as members of an organized group.

Substitutes

Substitutes were probably the most dynamic force on computer home software manufacturers in 1982. A substitute is determined by defining the function of the market's products. Computer home software is designed to primarily entertain and educate at home. Computer home software vendors must therefore compete for consumer dollar with products such as video game systems, TV, cable TV, and stereos, as well as books, magazines, and toys. Advertising geared at developing consumer computer awareness is the primary method computer home software vendors are using to increase entertainment dollar market share.

Threat of Entry

The final competitive force, threat of entry, is defined as the awareness by present vendors of the potential of new manufacturers (known or unknown) that may enter the industry. New entrants bring new capacity, the intention of gaining market share, and often substantial resources. A present major threat of entry to the personal computer marketplace (as well as the computer home software market) is Japan. Various Japanese vendors will enter the U.S. market for personal and home computers by 1983, and computer home software will be introduced along with these systems. These new competitors will create added competition for revenue and

for dealer access. Retail space confinements will force product dealers to limit retail and support after sale. In view of this competition, present vendors will need to create incentives for distributors to continue carrying their products.

Other potential entry threats may occur by acquisition. When a small, struggling vendor is absorbed by a larger company, capital and organizational structure are added creating a new competitive force for present vendors. For example: the 1976 acquisition of Atari by the entertainment giant, Warner Communications. With the proper management, products, and marketing, by 1981, Atari became the major force in video game systems, and a major force in the home computer market as well.

Backward integration can also occur by independent software companies acquiring hardware manufacturers, thereby creating a complete system. A case in point is Peachtree software and its alignment with MSA. Peachtree, a micro-computer software vendor, was acquired by MSA, a financial software supplier for mainframes and minicomputers.

As governmental regulations restricting AT&T from entering the hardware distribution market are lifted, information service vendors have the threat of this huge highly integrated company entering their market.

Barriers that prevent these possible competitive threats from entering the computer home software industry will be presented in the Competition chapter.

INDUSTRY STRUCTURAL CHANGES

This section will include evolving trends that could affect dramatically the computer home software industry. These trends include:

* Buyer awareness changes
* Long-run change in growth rate of demand
* Technical innovations
* Social/political influences

Competitive trends (e.g., market and firm size increases, entry of large established firms from other markets, and distribution changes) will be discussed in the Competition chapter.

Only now, in the 1980s, are computers beginning to be accepted by the average consumer. Society's "computer fear" is gradually diminishing due to the widespread exposure to friendly human-machine interfaces (e.g., automatic tellers, point-of-sale terminals, and TV computer games). As more and more people in school and the workforce become confident of their ability to interact with computer-type products, computer literacy will rise. As consumer computer awareness and literacy rise, so will their desire to purchase.

The aforementioned trends are basically environmental issues influencing buyer attitude. To complement these changes, hardware and software manufacturers as well as retailers and distributors must advertise aggressively. Most personal computer manufacturers have begun television advertising designed to "raise the consciousness of the American public. Advertising campaigns are also attempting to overcome consumer fear of computers by accentuating user friendliness with well-known entertainment figures, such as Bill Cosby (TI) and Dick Cavett (Apple).

What Does the Buyer Want?

Thus far, the major key to successful product design, as well as advertising, has been almost totally overlooked by home computer and computer home software vendors. The key is the answer to the question, "what does the buyer really want in a home computer product?"

Major companies, such as TI, have, in the near past, produced home products such as the TI 99/4 (initially marketed in 1979), hoping to educate the public as to the benefits of new technologies. In regard to the TI 99/4, consumer buying persuasions were not considered, and the product, priced over $1000 (configured with monitor), sold very poorly. Consequently, the product was redesigned and price cut several times. In 1982, the same basic unit interfaced with a TV and sold very well at less than $300.

The above example illustrates the issue of price sensitivity. The professional market for most major goods is performance-driven, with little price sensitivity. The consumer market, however, is extremely price sensitive. Considering this fact, a personal computer product must cost under $500, and preferably under $200, to effectively tap the consumer market. Consumer home software must be comparably lower priced than business software. Even a financial- or business-type software package geared toward the home market

must be priced well under $100, probably closer to $50, to ensure success.

Besides demanding low-cost computer products, the consumer insists on products that are "user-friendly." The consumer needs to be able to buy a machine, take it home, and have it work. Any type of development that helps to simplify the way in which users and computers interact is said to contribute to "user friendliness." Generally, technological innovations in hardware and software, such as interfaces, display, and storage capacity, directly impact a product's "user friendliness." However, product design such as keyboard size and key color and documentation also support the same result.

Consumers also want personal computer products that have the standard "look" of consumer products (i.e., distinct packaging). This could include sleek design, muted colors, and perhaps chrome when considering hardware, and nicely decorated boxes with colored graphics designs for software. Several entertainment software companies have also included a picture of the game designer on the back of the software package, contributing to the "rock star" image of many game programmers idolized by game enthusiasts.

To a somewhat lesser extent, the computer system's physical size will come into consideration within the forecast period of this study. As the larger personal computer systems become more portable, they will be of more appeal to the home market. Due to room size and space allocation, a consumer will more likely choose a product that can be folded and put in a closet when not in use (as is a portable typewriter), rather than a product that requires an entire table or shelf.

By 1985, a home computer will need the inherent capability to interface with data services. Information services are growing in function and ease of use. As this trend continues, consumers will want to utilize their services and will want not to spend extra time and money on attachments for their computers to perform these functions. Today, information service users spend most of their time using personal communication services such as "chat," but the consumer videotex market of transaction processing in financial services such as banking is greatly increasing in demand.

Major present computer home software packages are for entertainment and developing computer literacy. Educational software applications are increasing in popularity. Discovering home applications that cannot be more readily performed by alternate appliances, or the user himself, will prove the key to increased profitability. For example, functions such as recipe filing can be done more simply with a boxed index file (versus inserting information and performing search-and-print functions), so this type of application on a home computer offers little marketability. Many financial applications can be performed on a semi-sophisticated calculator. Therefore, the necessity of performing a software product's application via computer will influence end-user purchasing.

Long-run Change in Demand

The hardware and software industries are clear examples of the "chicken-and-the-egg" syndrome. Is it the sale of more personal computers that increases software sales, or does the proliferation of software sell hardware? Perhaps it is a combination of both.

Due to decrease in cost and increase in capability, microcomputer sales are increasing at a 59 percent annual growth rate. Decreasing prices are also placing increasing numbers of microcomputer systems within the purchasing range of the home market. Increased system capability and capacity provides software developers with the inherent tools to create new, unique, and user-friendly software packages.

As more personal computer systems are demanded and the capability for utilizing new or more sophisticated home applications increase, software production, too, is increasing. TI has stated that the number of software packages compatible with its 99/4A is expected to double yearly. Atari predicts a tenfold increase in software for its personal computers between 1981 and 1983. Independent software companies of home products are expanding sales at an average of over 50 percent per year.

The influx of personal computers into the home may also alter the type of application package that the consumer may demand. Although entertainment packages were of primary importance in the computer home software market in 1982, perhaps as present users begin to experiment with other functions of their computers, home management will become a major desired application. If this be the case, then

specialized entertainment software manufacturers may need to diversify their product lines to include financial applications.

The add-on trend also pertains to the demand for computer home software. The average purchase price of a personal computer in 1981 was $1000. Within one year, an average of $800 in peripherals (hardware and software) was added. With lower-priced home systems (under $500), the first-year add-on was closer to $300. About $150 of those first-year increases were specifically for software. Second-year add-ons consisted primarily of software packages. As the personal computer installed base increases, so will the potential end-user market for home application packages.

Technological Innovations

Since hardware and software go hand in hand, technological trends are of importance in both areas. Specific microcomputer technological trends will be discussed in the Technology chapter of this study, while this section will deal with specific innovations in software. The technological changes to be covered that affect the home software market include:

* Languages
* Interfaces
* Deterrents to software piracy

Languages are of great importance in producing a "user-friendly" computer product. LOGO and PILOT have been mentioned earlier in this chapter as newly evolving languages in the home market. Although not yet competitively priced enough to be used on personal computers for home applications, the language Small Talk by Xerox is an even closer step toward the ultimate computer language for consumers — English. A small company in California named Tyco Systems is also busy developing a high-level language incorporated in an operating system that uses full English phrases. Within the forecast period, Small Talk and similar languages resembling English will not be available as programming languages for computer home software. BASIC, and increasingly, PILOT and LOGO, will continue to be the home application favorites. Small Talk was incorporated in the development of Apple's high-end Lisa computer.

Interfaces are instrumental in simplifying the interrelationship between user and computer, creating a more "user-friendly" product. An example of a computer product that by interfaces (as well as by display and other software technological innovations) maximizes ease of use, is the Xerox Star. Although not priced for the consumer market, the Star is the prototype of computers for the future. Using the product, software programs are done more intuitively than with conventional software packages. An example is word processing — no manual is necessary. The user "writes, cuts, and pastes" on the screen, almost as if done with pencil and paper but with a computer-generated and neatly configured end result.

As English is the ultimate computer language, bypassing the keyboard for input and output is another major advance for computer/human interaction. This also is being made possible through interface design. The "Mouse" is a Xerox interface that allows the user to bypass the keyboard by moving a plastic shell on ball bearings across the table. The Mouse is attached by wire to the computer, and where the Mouse is moved, so too is the screen cursor. Speaker-independent voice recognition is an interface trend of the future that would also require little use of the keyboard. To accomplish this result, however, a great deal of memory and processing power must be used. Present personal computers have neither in abundance. Apple's $10,000 Lisa is the first to incorporate the "mouse" in a microcomputer.

Software compatibility among vendors would be an end-user's dream. To have the ability of using any available software package on the market on a specific system would increase the demand for that system as well as the demand for the best software packages. Presently there is a hardware interface called an emulator that is capable of producing compatibility. The Apple III has an emulator switch by which Apple II software can be run on the Apple III machine. Commodore has announced that it will soon begin marketing for its Commodore 64 with an emulator in February 1983 for less than $100. This would allow the product to use any type of available software, providing Commodore with a major market advantage if it can deliver the product.

Software program piracy, defined as reproducing software for unauthorized use, consists of:

* Copying and giving away (or selling) a piece of published software to a friend

* Making changes in a vendor's program and marketing the new version as an original

* Forming a business to duplicate and sell another vendor's software

For every legal program sold, especially in the entertainment area, it is estimated that as many as ten copies are transferred illegally. Such action is leading to increased retail prices in software, and, specifically within the computer home software market, could lead to a major decrease in innovative software development. Since legal recourse remains so expensive and time consuming, software publishers are seeking other means of protecting their programs. One such method is the use of an ecrypting disk with copy protection codes. "Softlock" is one of these programming aids of piracy prevention. It provides a counter inside the program package that turns off the software application if it is tampered with. The effectiveness of encrypting devices is questionable, but, as of yet, no more successful piracy deterrent has been discovered.

Socio-political Trends

Governmental legislation and regulations, as well as behavioral trends within society, have the potential of greatly influencing the personal computer home software market.

Political

By government deregulation and less-strict interpretation of antitrust provisions, major U.S. conglomerates are being allowed to enter once-protected markets. Three examples of this are IBM, AT&T, and Comsat.

In 1979, the restrictions that precluded IBM from entering the U.S. computer service business expired. IBM now has the ability to enter the telecommunications market, once only AT&T's domain. The beginning of IBM's entry may be investment in Satellite Business Systems, a company that designs and installs networks to transmit business information via satellite.

Beginning in 1980, AT&T has participated in any number of court cases and rulings with the attempt by smaller companies and consumers at limiting AT&T's power, or at least preventing it from spreading into other competitive fields.

The resultant Supreme Court hearings and rulings have allowed AT&T entry into the information processing market — the hardware market dominated by IBM. AT&T has quite an advantage before even entering the hardware field — established distribution channels. The company has thousands of retail phone stores that could easily incorporate computer sales as soon as products are available.

Satellite communication for the past 20 years has existed only in the commercial sense. On June 16, 1982, the FCC extended the potential satellite operation market by approving direct broadcasting via satellite (DBS) to homeowners' rooftops. This market is expected to become, in a short period of time, a $5 billion-per-year market. Comsat, which has had almost exclusive monopolistic rights on satellite communications by previous government regulation, is determined to become the new DBS leader. The company has already filed government proposals, and is producing hardware for home owners who choose to participate in this service.

The three aforementioned cases will affect the computer home software market in several ways. The IBM and AT&T cases will lead to the expansion of the overall personal computer market by an increase in hardware for the market and available communication services (i.e., an increased computer home software market potential). Home satellite communication services will infringe on the computer home software market by utilizing a percentage of consumers' disposable income — the same till from which computer home software is purchased.

Entertainment Software Social Trends

Specifically regarding the computer home software entertainment field, major social trends are directly impacting the personal computer industry. Since entertainment and computer literacy are the key home market applications, the availability of recreational software for a specific personal computer system influences that system's sales. It is a known fact that the availabiity of quality entertainment software packages was a major reason for Apple's personal computer market success. Also, 55 percent of those who buy a personal computer for business purposes also use it for gaming. When the IBM personal computer was in the design stages, it was configured with sufficient power and capabilities to handle good gaming software; this was even though the system was being marketed primarily as a business machine.

The refinement of computer games by category is occurring and each developing market niche (such as fantasy, sports, adventure, and simulation) will become more distinct in the future. To follow this trend, retailers may begin to tailor their store's product mix to their clientele.

FCC Radio Frequency Interference (RFI) Requirements

Microcomputers and other electronic devices emit radio frequency signals which can interfere with radio signal transmission. Because of this, the Federal Communications Commission (FCC) has issued regulations concerning acceptable radio frequency interference (RFI).

The FCC has classified all computers under two categories: Class A devices are those used in commercial environments, and Class B devices are those used in a home environment or widely sold to the public. It is theorized that it is more likely that consumer Class B devices will be located closer to radio and television receivers, that consumer products are generally of lower technical quality, and that they are less likely to be maintained than Class A commercial devices. For this reason, all manufacturers of Class B devices had to register their products with the FCC by January 1, 1981, or else discontinue sales. Class B manufacturers must also certify, using detailed standardized testing, that their products meet certain radio frequency radiation and conduction standards. Class A manufacturers must only state that their products meet certain standards, which themselves are much less stringent than for Class B devices. Furthermore, Class A manufacturers are under no obligation to register their products with the FCC.

The result of these standards, aside from less RFI, is that a significant barrier to entry has been erected for small start-up firms seeking to market microcomputers classified as Class B. The level and expense of testing required may be beyond the ability of poorly financed firms.

Legal Protection for Computer Hardware and Software

One of the biggest detriments to individual hardware and software development is that once a product is invented, in most cases very little can be done to keep the product from being "stolen" or mass marketed by a competitor.

There are three forms of legal protection that can apply to computer innovations:

* Patents
* Copyrights
* Licensing to customers

Although each protection is a type of product authoring, they differ in many ways.

To qualify for a patent, a product must be <u>new</u>, <u>useful</u>, and <u>unobvious</u> in light of prevailing technologies. To be granted a patent, an application must be filed with the U.S. Patent and Trademark Office, which then conducts research to determine whether or not the product meets the above three criteria. If a patent is granted, the applicant has the exclusive right to make or sell the invention in the United States for 17 years. However, the patent procedure has several drawbacks. First, the patent process is generally long (about 18 months); secondly, expensive; and thirdly, many innovations, as mathematical algorithms and most software programs, would not qualify. Patents would apply more specifically to computer systems with inclusive programs or hardware products in general.

A copyright is related to software protection and is to prevent others from directly copying an author's program. Receiving a copyright is a rather simple and inexpensive procedure. The program must be registered with the Copyright office, along with a $10 fee. Once the copyright is granted, as is generally the case, the coverage extends for the author's life plus 50 years. This form of protection, however, is far less powerful than a patent. With a copyright, <u>only</u> the source listings can be protected -- not the procedure or idea. Therefore, a competitor could use a given procedure and idea, develop a similar but not exact replica program, and not be infringing on the copyright at all. Similarly, another author could develop an exact program copy, <u>but</u> using a different procedure, also be excluded from infringement -- only <u>actual copying</u> is prohibited.

Restrictive licensing between software designer and customer is the last form of legal protection. A licensing agreement can be drawn up by a patent attorney whereby stating that the software remains the author's property that the customer may use but not reproduce for use by others. This limits the sale or trading of the author's product to another party without his/her knowledge.

The entire area of computer innovation protection is very new, and few clear-cut options exist for authors. Congress is continually being asked to establish more protection options which would aid in encouraging entrepreneur innovations outside the corporate umbrella. This would especially pertain to the computer home software market where well over 50 percent of present products were created by independent software designers.

Video Game Systems, Cable TV, and Networking

The infusion of video game systems, VCR, and cable TV, as well as networking into the home, will also tend to influence the personal computer market. As users outgrow the gaming capability of a video game system, they will often trade up to a home computer system for more sophisticated applications. The cable TV system called QUBE by Warner-Amex Communications in Columbus, Ohio, received rave reviews by subscribers. The system allows subscribers by two-way cable to talk back to their TV sets. For electronic shopping and other personal transactions, this type of product may prove to be highly competitive with computer information services, one of the major computer home software applications.

Education

Computers used in education influence computer usage in homes in several ways. As more children are exposed to computers in schools, more parents invest in a home system to aid in learning. Few parents can resist supporting their child's educational development. Generally, when a parent purchases a computer for his/her child, it is the same vendor's system used in the child's school. Thus, the brand of personal computer used in schools increases the market potential for that brand system being purchased in the home market. For example, the VIC-20 Commodore originally concentrated marketing efforts for this product (as well as for the PET) on school systems. Consequently, this initial marketing decision proved a key factor in Commodore's successful penetration of the home market.

Second, by educating the children of today, one prepares the consumers of tomorrow. More computer-literate consumers translates into increased sales in the future personal computer and computer home software markets in general.

In summary, the computer home software market, although in its infancy, is one of the fastest growing areas within the overall computer software market. As more personal computers are purchased for home use primarily due to declining system cost, end-user computer awareness and home software purchases will also increase at an even higher rate.

All home application segments will prosper (i.e., entertainment, home management, educational, and other), however, to different degrees. Languages will become simpler and more user friendly, as will computer home software mediums -- cartridges and disks being the primary mediums of the future.

Primary current vendors (i.e., hardware vendors of software and software-independent companies) will be challenged in the near future by large companies such as publishers, movie manufacturers, video grame makers, and Japanese hardware and software suppliers. Forward-looking, well-planned strategies will need to be created and implemented for present vendors to retain significant market share. Strategy should include:

* Assessment of distribution channels
* Buyer awareness and demands
* Technological innovations
* Socio-political trends
* Present and future competition

Market

The computer home software market offers:

* High risk and high potential return on investment

* Marginal barriers to entry

* Lack of industry-wide standards

* Shortage of quality people to program computer home software packages

The software market relates directly to the personal computer hardware market in that:

* Personal computer owners are recognizing the personal computer as a productivity improvement tool for everyday home activities, such as budgeting, tax preparation, and supplemental education for all age levels. For these owners, entertainment is already a given.

* In the past few years, more efficient merchandising policies, such as advertising and new distribution channels, have been employed by computer vendors. As a result, more personal computers for the home are being sold, thereby creating a demand for more computer home software.

* Technological advances in hardware production have resulted in dramatic personal computer price decreases, leaving the user with more funds for software expenditures.

HOME HARDWARE OVERVIEW

In 1982, 2.1 million computers were purchased in the United States specifically for home use (see Table 3). This shipment number is expected to increase to over 7 million units in 1987. The biggest increase in unit shipments is expected in 1983 to 1984, due to the continuing price decline, the increase in computer awareness, and, to a lesser extent, the availability of videotex-type services. Unit growth rates in 1985 and 1986 will be lower than in other years, as in other U.S. markets, due to a predicted recession based on a 3.5- to 4-year business cycle. Considering retirements, Creative Strategies International expects a 13 million unit U.S. installed base of computers in the home by 1987, or about 15 to 20 percent of U.S. households. Table 4 breaks down the home market microcomputer potential by heads of households, which can prove helpful in considering possible market penetration; however, many of the lesser-educated heads of households will now, and in the future, seriously consider a home computer, not for themselves but for their children, so that they can be prepared for the "computer age." Therefore, market potential may be greater than Table 4 indicates.

As the U.S. home microcomputer market expands, non-U.S. markets are following suit. About 300,000 computers were sold for home use internationally in 1982. This figure is expected to increase to 3 million units in 1987.

Revenue for computers in the home in the United States in 1982 was about $850 million. With systems such as the Apple II, and to a lesser extent the Atari 800 and IBM Personal Computer, included in 1982s market, the average unit price (AUP) per home system was somewhat higher than expected -- $425. If only under-$300 home computer systems were to be

TABLE 3
MICROCOMPUTERS SHIPPED FOR HOME USAGE, 1982
(Millions of Units)

Company	1982 Shipments	Percent of Market Share
Apple	.064	3%
Atari	.400	19
Commodore	.525	25
Radio Shack	.120	6
Sinclair/Timex	.600	28
Texas Instruments	.405	19
Others	.0008	—
Total	2.115	100%

Source: Creative Strategies International

TABLE 4
U.S. HOME MARKET MICROCOMPUTER POTENTIAL

Educational Level	Number of Household Heads	Potential Microcomputers* per Household Head	Potential Microcomputers by Educational Level
Less than 8 years	7,980,000	Insignificant	—
8 years	7,068,000	0.001	7,000
1-3 years of high school	11,096,000	0.005	555,000
4 years of high school	25,308,000	0.33	8,352,000
1-3 years of college	11,400,000	0.75	8,550,000
4+ years of college	13,072,000	1.0	13,072,000
Total:	75,924,000		30,536,000

*CSI estimate

Source: Creative Strategies International

considered, the AUP would have been about $200, especially due to the Sinclair ZX-81. Home computer revenues are expected to increase significantly yearly, while the AUP per system will decrease by 17 percent compounded annually.

COMPUTER HOME SOFTWARE OVERVIEW

As hardware shipments to the home increase, so too will shipments of computer home software, since they are directly related. Worldwide computer home software shipments are expected to grow from 4.7 million units in 1982 to 116 million units in 1987, with revenues in retail value of $239 million in 1982, growing to $5 billion in 1987 (see Table 5). International shipments are less than 20 percent of the total in 1982, but will make up almost 40 percent of total shipments in 1987. Expenditure estimates for computer home software were derived by determining the amounts of software packages: (1) sold with the hardware system, (2) sold in the first year after purchase, and (3) the units sold to the installed base. These numbers were multiplied by a factor that reflected the various home systems market share, multiplied by an average software price, resulting in a weighted average software cost per unit. In addition, a retirement factor for software systems was used to more accurately reflect software sales in future years.

In researching a dynamic market such as the computer home software market, it is important to attempt to draw correlations from other dynamic industries that could have a similar product growth path. It is interesting to note the growth associated with the market for video cassette recorders and how closely it relates to the growth associated with home personal computer systems. In the period from 1978 to 1982 (from product major introduction into the consumer market and the ensuing growth), sales of video cassette recorders grew at a compound annual growth rate of 37 percent (see Table 6). The growth rate in the video cassette recorder (VCR) and home personal computer industries is much lower than that in the related market of video game systems (compound annual growth rate of over 100 percent), since VCRs and home personal computers are more sophisticated, thereby costing more, and are somewhat more complicated to use.

TABLE 5
COMPUTER HOME SOFTWARE MARKET, 1982 – 1987

	1982	1983	1984	1985	1986	1987	CAGR*
Units (in thousands)							
U.S.	3,986	9,705	20,513	35,189	55,467	72,860	78%
Non-U.S.	797	2,717	7,385	15,483	28,843	43,716	122
Total	4,783	12,422	27,898	50,672	84,310	116,576	89%
Percent of U.S.	0.83%	0.78%	0.74%	0.69%	0.66%	0.63%	
Revenues (in millions of dollars)							
U.S.	$199	$476	$ 985	$1,654	$2,551	$3,279	75%
Non-U.S.	40	133	354	728	1,327	1,973	118
Total	$239	$609	$1,339	$2,382	$3,878	$5,252	85%
Percent of U.S.	0.83%	0.78%	0.74%	0.69%	0.66%	0.62%	

*CAGR = Compound Annual Growth Rate

Source: Creative Strategies International

TABLE 6

VCR SALES AND REVENUE GROWTH, 1978 – 1982

	1978	1979	1980	1981	1982
Units (in thousands)	415	488	802	1,471	2,000
Revenues (in millions of dollars)	$326	$389	$621	$1,127	$1,500

Source: Creative Strategies International

Computer Home Software Growth by Application Segment — U.S. Only

In 1982, of the $199 million (retail value) of U.S. computer home software shipped, about:

* $106 million or 53% was for entertainment software
* $ 38 million or 19% was for educational software
* $ 45 million or 23% was for home management software
* $ 11 million or 5% was for other software

(See Table 7.)

Viewed from a shipment perspective, 57 percent of 1982 shipments were entertainment packages, 22 percent education, 18 percent home management, and 3 percent other (see Table 8). The difference in a higher percent of revenues for home management packages versus education packages is due to the higher AUP for home management packages.

All segments anticipate a healthy growth through 1987, but the market share of entertainment will decrease slightly, while the other three segments will increase. This will be due to several factors:

* Growth in the areas of videotex, electronic shipping, and banking will increase the "other" category.

* AUP of markets differ and greatly influence revenue (i.e.,in 1982, entertainment software was about $25, home management $70, and education $30. A small increase in home management packages can greatly increase revenues for that segment -- more so than an increase in sales for entertainment or educational software).

* Education packages will increase in sales as more parents realize the advantages of instruction (via fun) on a computer.

* Entertainment will remain an important use of computers in the home, but as the AUP of disk/ cassette/cartridge decreases and the preceeding 3 trends occur, entertainment revenues will be a smaller piece of the pie.

TABLE 7
COMPUTER HOME SOFTWARE U.S. APPLICATION SEGMENT GROWTH
(Millions of Dollars)

	1982	1983	1984	1985	1986	1987	CAGR*
Entertainment	$106.0	$232.6	$472.9	$ 776.0	$1,148.2	$1,442.3	69%
Education	37.9	91.2	202.7	346.7	549.1	753.9	82
Home Management	44.7	104.9	231.6	412.8	624.0	852.3	80
Other	10.7	27.4	57.9	115.6	174.7	229.5	84
Total	$199.3	$456.1	$965.1	$1,651.1	$2,496.0	$3,278.0	75%

*CAGR = Compound Annual Growth Rate

Source: Creative Strategies International

TABLE 8
COMPUTER HOME SOFTWARE APPLICATION SEGMENT GROWTH
(Percent of Entire CHS Market Shipments)

Application Segment	1982	1983	1984	1985	1986	1987
Entertainment	57%	53%	49%	47%	46%	44%
Education	22	23	24	25	25	26
Home Management and Finance	18	19	21	21	22	23
Other	3	5	6	7	7	7
Total	100%	100%	100%	100%	100%	100%

Source: Creative Strategies International

1982 Application Markets by Vendor

In 1982, 27 percent of all wholesale revenues received for entertainment software was received by hardware vendors, 73 percent by independent software companies (see Table 9). The percentages shift greatly in favor of hardware vendors in the areas of home management and education. Again, this is due to the installed base of Tandy and Commodore, who supply the majority of software packages for their systems, and to the newness of independent software companies -- the majority of which provide entertainment packages. 1982 was the first major year for larger independent companies who supply home management software.

Entertainment Market

In 1982, software vendors received over $62 million wholesale from entertainment software. Table 10 shows the breakdown of this revenue according to vendors, as well as its percentage of each company's overall wholesale revenue. In the case of Atari and independent software companies, entertainment revenues made up a comfortable majority of total company revenues.

Figure 5 divides the entertainment market in yet another way. It shows wholesale revenues divided by hardware systems on which the software packages run. In 1982, Apple and Atari were the leading systems from which entertainment software revenues were accrued.

Educational Market

In 1982, over $12 million in wholesale revenues was earned by software vendors from the sale of educational software (see Table 11). Total independent software companies earned in 1982 about as much as total hardware vendors from educational software sales. However, dollars earned accounted for only 9 percent of overall independent software companies' revenues, while educational dollars accounted for 21 percent of Commodore's software revenue and 33 percent of TI's software revenue.

Figure 6 again shows the lion's share of educational software revenue being used on TI and Radio Shack systems. In the near future, as more hardware systems from IBM, Atari, Commodore, and Apple are bought for home use, and quality, "fun," stimulating educatonal software becomes available, the percentages in Figure 6 will drastically change.

TABLE 9
MARKET SHARE BY COMPUTER HOME SOFTWARE SEGMENT, HARDWARE VERSUS SOFTWARE COMPANIES
(Percent of Wholesale Revenues)

Segment	Hardware	Software
Entertainment	27%	73%
Home Management	59%	41%
Education	58%	42%

Source: Creative Strategies International

TABLE 10

1982 U.S. ENTERTAINMENT MARKET
BY VENDORS OF COMPUTER HOME SOFTWARE
(Millions of Dollars)

Company	Wholesale Revenue	Percent of Company Sales
Apple	$ .72	26.0%
Atari	6.87	73.0%
Commodore	.55	28.0%
Radio Shack	5.76	36.0%
Texas Instruments	3.42	33.5%
IBM	—	—
Sinclair	—	—
Other*	45.07	73.0%
Total	$62.39	

*independent software companies

Source: Creative Strategies International

FIGURE 5
1982 WHOLESALE ENTERTAINMENT REVENUES
(BY HARDWARE SYSTEM)

$62.38 M Total

32% Apple ($19.87 M)

32% Atari ($20.11 M)

15% Tandy ($9.58 M)

9% TI ($5.37 M)

6% Commodore ($3.64 M)

3% IBM ($1.98 M)

3% Other ($1.74 M)

Source: Creative Strategies International

TABLE 11

1982 U.S. EDUCATION MARKET
BY VENDORS OF COMPUTER HOME SOFTWARE
(Millions of Dollars)

Company	Wholesale Revenue	Percent of Company Sales
Apple	$ .36	14.0%
Atari	.86	9.0%
Commodore	.41	21.0%
Radio Shack	2.3	14.0%
Texas Instruments	3.42	33.5%
IBM	—	—
Sinclair	—	—
Other*	5.23	9.0%
Total	$12.58	

*independent software companies

Source: Creative Strategies International

FIGURE 6
1982 WHOLESALE EDUCATION REVENUES
(BY HARDWARE SYSTEM)

$12.57 M Total

52% Other ($6.60 M)

23% Apple ($2.87 M)

16% Atari ($2.03 M)

9% Commodore ($1.07 M)
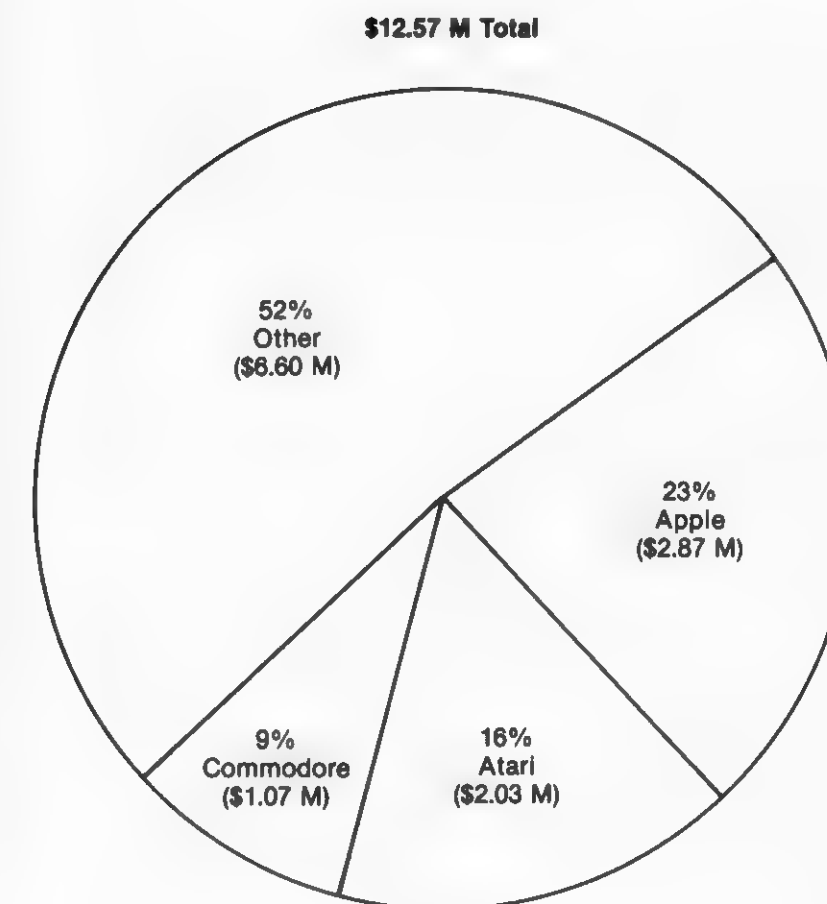
Source: Creative Strategies International

Home Management Market

In 1982, software vendors received over $27 million wholesale from home management software. Table 12 shows revenues of software vendors from home management packages, with the leaders in revenues being independent software companies and TI. Home management revenues accounted for over 50 percent of software wholesale revenues of Apple, Commodore, and Radio Shack.

Figure 7 shows that over 50 percent of 1982 wholesale home management software revenues came from software used on systems other than Apple, Atari, and IBM. The two main "other" hardware systems were TI and Radio Shack. It is interesting to note that, even though the IBM Personal Computer has been on the market for only about one year, software for it in the area of home management accounts for 7 percent of overall home management 1982 revenues, compared to Apple, whose past five years in the business resulted in 31 percent of software home management revenues for that system.

Wholesale Versus Retail Revenues

Computer home software is as any other end-user tangible commodity -- a combination of pieces, produced by various divisions of a company, and then distributed by whatever means are assumed best to make a profit.

If one were to take a $30 retail price of computer home software back to its creation, one would find that the original cost to manufacturer was $10.77, broken down as follows:

37% –	$ 4.00	Duplication and manufacturing
7% –	.75	Packaging
10% –	1.00	Support
23% –	2.50	Royalty
23% –	2.50	G&A (general administration and advertising)
	$10.77	

To make a profit on the sale of a piece of computer home software, a manufacturer must apply a markup on margin. There is generally a 35 percent margin from producer to wholesale cost. When a distributor is used (such as Softsel), there is generally another 15 percent margin between wholesale price and distributor, and if a retailer (such as ComputerLand) is
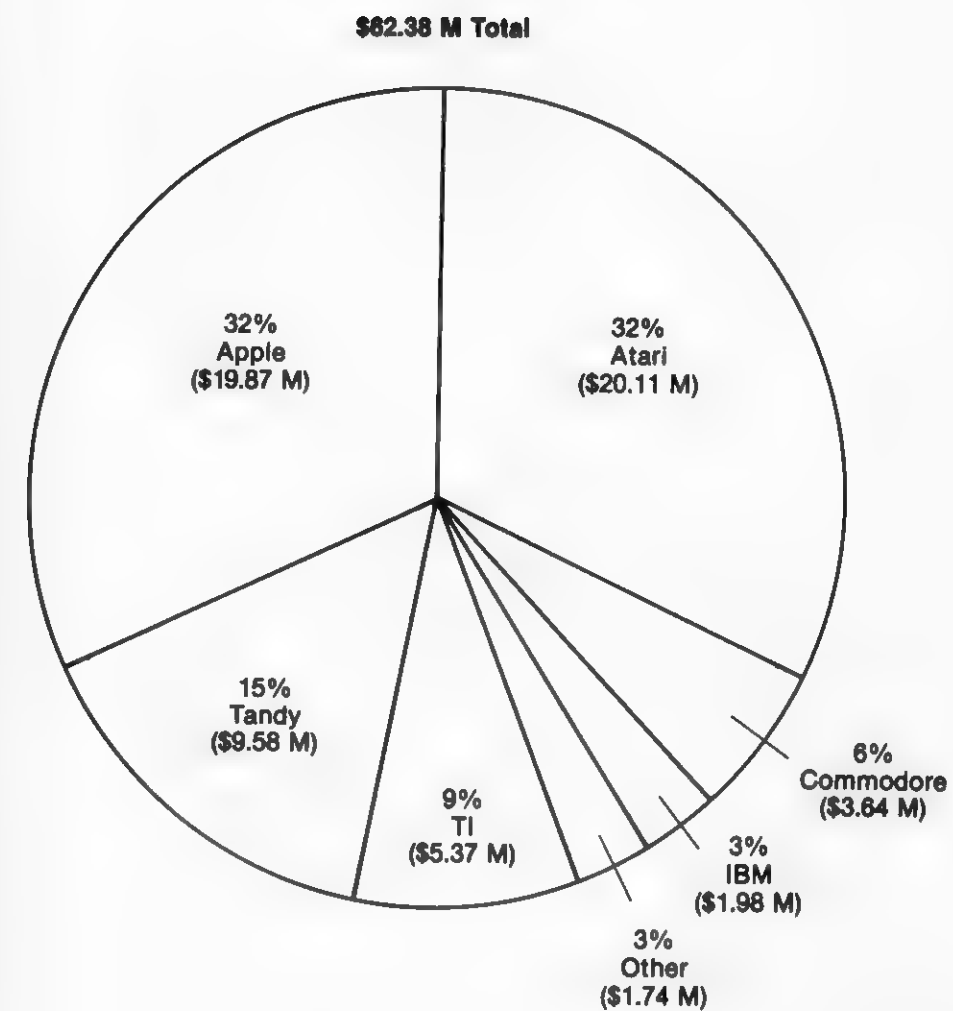
TABLE 12

1982 U.S. HOME MANAGEMENT MARKET BY VENDORS OF COMPUTER HOME SOFTWARE
(Millions of Dollars)

Company	Wholesale Revenue	Percent of Company Sales
Apple	$ 1.69	60%
Atari	1.72	18%
Commodore	.98	51%
Radio Shack	8.29	50%
Texas Instruments	3.41	33%
IBM	—	—
Sinclair	—	—
Other*	11.16	18%
Total	$27.25	

*independent software companies

Source: Creative Strategies International

FIGURE 7
1982 WHOLESALE HOME MANAGEMENT REVENUES
(BY HARDWARE SYSTEM)

$27.26 M Total

54%
Other
($14.64 M)

31%
Apple
($8.20 M)

8%
Atari
($2.24 M)

7%
IBM
($1.92 M)
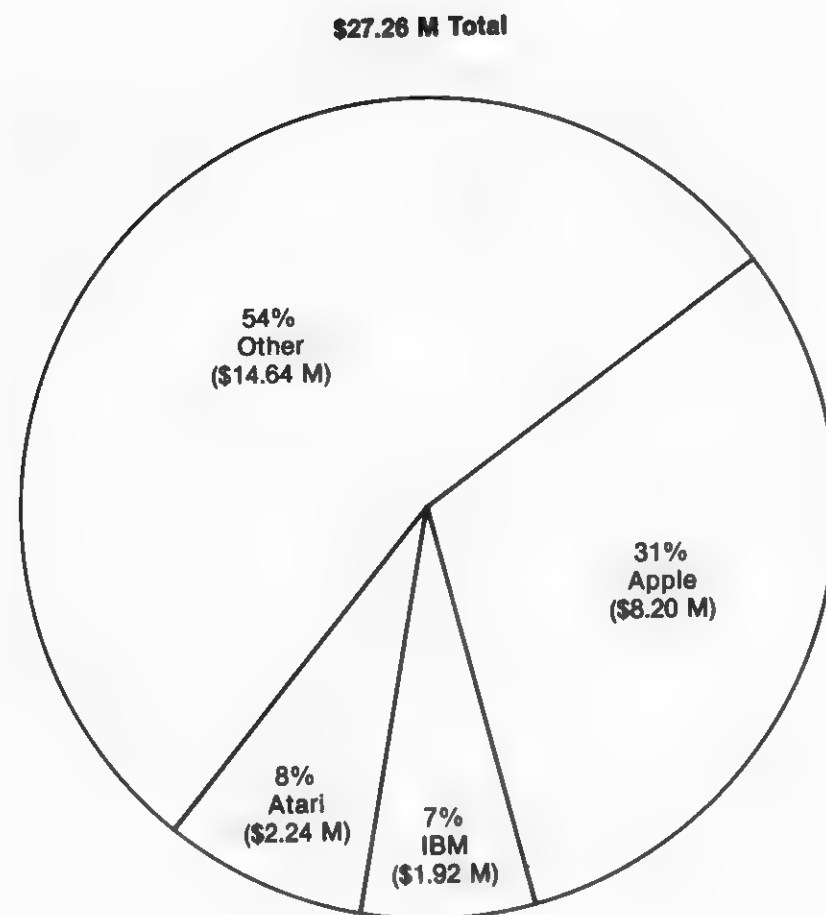
Source: Creative Strategies International

also the next link on the chain before user, then there is another 35 percent margin (see Figure 8).

Although many independent vendors of computer home software now distribute by mail order, enabling them to offer a lower-priced product, as competition in the computer home software area becomes increasingly fierce and end-users accept retail distribution "software-only" stores, these vendors may be forced to supply the market through a more "expensive to producer" means as a way of making a profit. Even though mail order is less expensive, if fewer units are sold, the channel will not prove cost effective for long.

Computer Home Software by Medium

Computer home software is produced on a variety of mediums -- cartridges, cassettes, and disks.

In 1982, 42 percent of computer home software that was sold was on cartridges. Although the cartridge is presently a more expensive medium to produce and can be used only for "read-only" applications, it is by far the most "user-friendly." This is due not only to package durability, but also to the fact that no added peripheral, such as a cassette recorder or disk drive, is necessary to run a program. The use of cartridges for home software, especially in the entertainment area, will increase due to several factors (see Table 13). First, cartridge packages "sell better" -- a common phrase quoted by most computer home software vendors. Second, many computer home software vendors are going out of business, not because of poor programs, but because of piracy, especially in the case of entertainment disks, where as many as ten copies are illegally distributed per purchased copy. Therefore, with disk programs, piracy reduces sales; with cartridges, piracy is difficult, thereby restricting illegal distribution.

Cassettes are used primarily for educational applications and are not a very reliable medium. Cassette usage is expected to decrease from 41 percent of programs in 1982 to 5 percent in 1987.

Diskettes will grow to be the primary medium for inter-active educational packages as well as for home management, where storage and work on diskette is necessary. As more computers in the home expand to disk drives, disks too will maintain a strong market share in the entertainment market.

FIGURE 8
**INCREASE IN PACKAGE COST
OF A UNIT OF CHS THROUGH
CHANNELS OF DISTRIBUTION**

Cost	35%	Wholesale	15%	Distributor		Retail
$10.77		$16.57		$19.50		$30.00
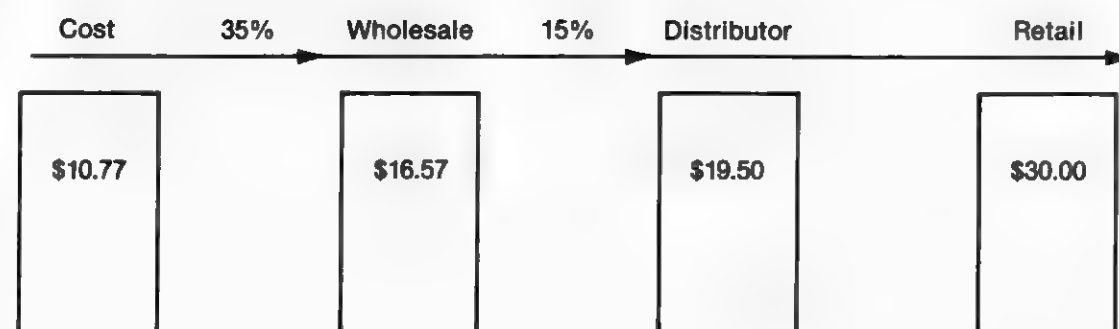
Source: Creative Strategies International

TABLE 13

COMPUTER HOME SOFTWARE BY MEDIUM
(Percent of Total Sales)

Medium	1982	1983	1984	1985	1986	1987
Cartridge	41.5%	41.8%	42.1%	42.4%	42.7%	43.0%
Cassette	41.0	33.8	26.6	19.4	12.2	5.0
Diskette	17.5	24.4	31.3	38.2	45.1	52.0
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Creative Strategies International

In summary, the market for computer home software will be affected by:

* The price of the hardware systems, which affects the potential home computer market

* The ease of use of these systems

* The value people attach to entertainment, or the applications that the computer will be used for

Now, a computer is somewhat of a luxury item -- not a necessity. The functions of home budget can be done reasonably well on paper with a calculator, and entertainment can be provided by an inexpensive video game system. Thus, when computers are able to demonstrate to users significant benefits over the current alternatives, systems sales and, in turn, software sales will increase. In addition, as computer prices come down to levels near video game systems, a significant percentage of the market will opt for increased funcationality and buy a computer system instead. In general, the computer home software market will show significant growth opportunities as the installed base of home computers grows. The companies that succeed will:

* Design products that take into consideration the needs and requirements of the present and future users in the computer home software market.

* Find sound strategies for dealing with present and future competition.

Technology

OVERVIEW

Declining hardware costs, increasing processing capabilities, and better applications software have been the key to the growth of the microcomputer industry. Declining systems prices have in turn led to a growth in the potential market for microcomputers, as they become more economical in various applications. Consequently, the greater the demand for microcomputers, the greater the demand for software.

Since there exists a symbiotic relationship between hardware and software, the Technology chapter of this study will deal with hardware components as well as the software of a microcomputer. The hardware will be focused on more heavily, since software technologies present and future have already been covered in detail in the Industry chapter.

Significant advances have been made in the past four years in microprocessors, semiconductor memory, and floppy and hard disk storage technologies. Continuing performance improvements can be expected. Figure 9 illustrates expected trends in microcomputer technology; these trends will be discussed in detail below. Figure 9 also illustrates a four-fold increase in performance every five years for a

FIGURE 9

IMPACT OF TECHNOLOGY ON THE MICROCOMPUTER

1985
• Widespread use of system to system translators
• Widespread use of sophisticated programming tools
• Increasing use of firmware
• Significant increase in active and storage memory

1984
• Increasing use of non-keyboard input devices ...
• Widespread microcomputer system integration
• Increasing use of 256K RAM
• 5-fold increase in floppy disc drive capacities
• Higher resolution CRTs
• Widespread use of integrated functional software
• Introduction of sophisticated "object-based" software
• Increasing use of Artificial Intelligence
• Integrated communications capacity for home computers

1983
• Spread of Local Network Systems
• 32-bit microprocessor-based microcomputers
• Increasing use of 16-bit microprocessor systems
• Increasing use of downloaded software
• Economical use of simple Artificial Intelligence for microcomputers
• Concurrent multi-tasking operating systems
• Use of 3½ inch floppy disc drives

Hardware Costs

Software Power

Source: Creative Strategies International

similarly priced microcomputer or, alternately, a 20 percent reduction in real dollar price per year for a system of similar performance.

The microcomputer as defined by Creative Strategies International has the following characteristics:

* The system contains a microprocessor unit, semiconductor memory, keyboard, power supply, operating system, software, and electronic components that allow for input and output of information (display and mass storage).

* The system is programmable by the end user in at least one high-level language (e.g., BASIC, FORTRAN, PASCAL).

* The system is operable in an independent standalone mode, although it may have the capacity to be linked to another computer, via a network system, or to a shared database.

* The end-user price of the system as configured by the manufacturer is less than $15,000.

Major vendors include:

* Altos	* Intelligent Systems
* Apple	* Intertec
* Atari	* NEC
* Casio	* North Star
* Commodore	* Ohio Scientific
* Cromemco	* Osborne
* Dynabyte	* Sharp
* Exidy	* Sinclair
* Fujitsu	* Sord
* Heath/Zenith	* Tandy
* Hewlett-Packard	* Texas Instruments
* Hitachi	* Vector Graphic
* IBM	* Xerox

MAJOR SUBSYSTEMS

Mainframe

Microcomputers contain a microprocessor, memory, power supply, circuit boards, connectors, cables, and other electronic components housed in an enclosure and referred to in sum as a mainframe.

Microprocessor

The microprocessor unit (MPU) is the key component of the microcomputer. It is analogous to a brain, but without memory capacity. The function of the microprocessor is to retrieve instructions from memory and to execute them. The microprocessor is composed of a group of electronic circuits that perform the calculating and logic functions of a program.

Presently produced microprocessors are generally based on a metal oxide silicon (MOS) technology. Most microprocessors utilize n-channel MOS (nMOS) technology, which has relatively high power requirements and noise susceptibility. hMOS, used in the Motorola 6809, scales down the electrical and physical parameters of the microprocessor for higher performance and smaller size. Still another technology, cMOS, offers increased performance due to low power dissipation and high noise immunity. hMOS microprocessors will make inroads on nMOS microprocessors in the coming years, but nMOS devices will remain popular because of large volumes of presently available machine language programs for these microprocessors.

The Debate Over 16-bit Microprocessors

Presently, most microcomputers utilize an 8-bit microprocessor. These MPUs are limited to a direct-addressing range of 64K bytes, or about 30 to 40 double-spaced typed pages of work space. The newer 16-bit microprocessors have a much larger direct memory addressing range than do 8-bit microprocessors.

In addition to the increased direct-addressing capacity of 16-bit microprocessors, these microprocessors are generally quicker than 8-bit microprocessors for some applications. Typical instruction speeds for 16-bit microprocessors are less than one microsecond, compared with one to five microseconds for an 8-bit microprocessor.

Because of their increased processing speed, 16-bit microprocessors can also support applications programs written in high-level languages such as BASIC and PASCAL, rather than in more cumbersome machine or assembly language. As a result, software development time can be reduced.

On the other hand, microcomputer manufacturers with large investments in proprietary software written for 8-bit microprocessors, such as word processing or accounting packages, high-level language interpreters, and operating systems, may be reluctant to convert to 16-bit microprocessors. Either the entire software base must be abandoned, or electronic translators must be employed to convert the 8-bit software to run on 16-bit microprocessors, reducing or eliminating the 16-bit microprocessor's initial processing speed advantage. Epson has announced a $3000 system using an 8-bit CPU, but offering most of the features of a 16-bit system. Special memory architecture is needed.

Other manufacturers are looking further ahead to the mid-1980s and the use of the 32-bit microprocessor. They are hesitant to commit themselves to a 16-bit microprocessor before they know whether or not it will be software compatible with future 32-bit microprocessors.

It may also be slightly more difficult to retail 16-bit microcomputers at the present time. It costs at least $100 at the manufacturer level to upgrade a microcomputer to a 16-bit microprocessor. This translates to at least $300 at the retail level. Present 16-bit microcomputers are typically priced above $2500, which may limit 16-bit microcomputer sales. The typical retail store can sell a system for $2500 to $5000 in adequate quantities to small businesses and professional offices. It is doubtful, however, that many retailers can successfully sell such a system to homes for exclusively home software use, or that homes can in fact afford a $2500 system.

It can be expected, therefore, that 8-bit microprocessors will be improved, with clock frequencies approaching 10 MHz in the next few years. As 16-bit microprocessors become even faster and component prices drop, they will gain more widespread acceptance.

Dedicated Memory

Microcomputers often contain a small amount of read-only memory (ROM). ROM is semiconductor memory that is

preprogrammed to store character generators, control functions, and in some cases to contain resident software, such as a high-level language compiler. Software stored on ROM can be accessed more quickly than software stored on peripherals such as tape or disk. With declining costs of semiconductor memory, manufacturers have enlarged the ROM size to include programming languages resulting in increased microcomputer computing power. Various microcomputer manufacturers have incorporated ROM plug-in cartridges into their products, which allow the user to plug a preprogrammed applications software cartridge into the system. By storing applications programs in ROM, execution time can be significantly decreased over that of floppy disks and tremendously decreased over that of audio cassettes.

Main Memory

Main memory typically consists of random access memory (RAM) semiconductor chips mounted on a circuit board and inserted into the card cage. Main memory is the user's workspace, in which programs and data are stored while the microcomputer is in use. Low-priced systems typically have 16K bytes of memory (equivalent to about five double-spaced typed pages), while higher-priced home systems often have 48K or 64K bytes of main memory.

Microcomputers can use either static or dynamic RAM, based on MOS technology. Static RAM is often employed in low-priced microcomputers, but dynamic RAM is gaining increasing acceptance because of lower manufacturing costs. Both types of semiconductor memory are, however, termed "volatile," because they are susceptible to data loss if power is turned off.

RAM densities have increased significantly in the last several years, and can be expected to increase still more in the coming five years. Although most microcomputer RAM memory boards rely on 16K-bit RAM chips, 64K-bit chips have recently become available in volume quantities.

It can be expected that the cost of RAM memory will continue to fall as densities increase.

Mass Storage Memory

RAM

RAM is not practical mass storage, because it disappears when its electric current is turned off. It is used here for comparison. RAM prices have declined substantially in the last few years, as much as 50 percent in some years over the previous year's prices. Still, the cost is comparatively high compared with competing mass storage technologies. Table 14 indicates comparative costs of various mass storage technologies. RAM's principal advantage is its file access time. For this reason, RAM memory is most economical for applications where speed is important, such as sharing a program, and data or text currently being accessed by the user. Likewise, mass storage is most economical for storage of large volumes of information not currently being accessed by the user, such as the full program library, and data or text used in association with those programs.

Cassettes

Low-end microcomputers, often found in the home or school, often rely on common audio cassette recorders for mass storage. A typical audio cassette can hold over 300K bytes (about 200 double-spaced typed pages) of information Cassette recorders, however, sometimes suffer from data dropout due to poor tape or recorder quality. Their relatively slow access speeds, as compared with other mass storage methods, have also limited their application.

Floppy Disks

Floppy disks offer an attractive alternative for applications requiring more speed and reliability in data transfer, which is typically required in most business applications. A standard 5¼-inch mini-floppy disk drive retails for a minimum of $300, with about 160K bytes of storage. Current technology allows 5¼-inch floppy disks to store about one million bytes of data. Higher priced, full-size floppy disk drives use 8-inch diskettes, which are able to hold as much as 1,200,000 bytes of data.

Sony Corporation has recently introduced a 3½-inch microfloppy disk drive with 437.5K bytes of storage on a single-sided, double-density format, offering the eventual potential of 875K bytes of storage in a double-sided format. Wholesale prices are expected to be $200 to $300. The advent

TABLE 14
MAJOR MEMORY TECHNOLOGIES
(Representative 1981 Performance)

Memory Type	Maximum[1] Storage Capacity (Bytes)	Cost/Byte[2] (in cents) Min.	Max.	File Access Time (in milliseconds) Min.	Max.
Dynamic RAM	8K – 64K	0.58	1.03	0.0002	0.0010[3]
Bubble Memory	128K – 768K	0.80	2.40	0.5	15
Hard Disk	6M – 101M	0.01	0.10	5	50
8″ Floppy Disk	250K – 1200K	0.11	0.64	45	260
5¼″ Floppy Disk	80K – 964K	0.22	0.77	30	600
Audio Cassette	50K – 350K	0.02	0.13	48000	480000[4]

[1] K = thousand, M = million

[2] based on retail prices to end users.
  Costs per byte typically decline for larger storage capacities.

[3] 200 nanoseconds minimum, 1 microsecond maximum

[4] 48 seconds minimum, 8 minutes maximum

Source: Creative Strategies International

of 3¼-inch floppies will allow microcomputer systems to become much more portable, as both physical size as well as power requirements are reduced.

It can be expected that floppy disk storage capacities will increase significantly in coming years, as indicated previously in Table 14. Increasing recording densities will be possible through better recording heads, as well as through changes in disk media to chromium-coated mylar or metal diskettes.

Hard Disks

Hard disk drives have been available to microcomputer users for several years. Winchester hard disks contain the head and disk assembly in a sealed, unremovable unit, thus protecting the disk from outside contamination. As a result, the disk assembly can be built to tighter tolerances, with resultant higher densities and better performance than floppy disk drives. Hard disks are also available in a removable disk format, allowing storage of vast amounts of information. As indicated in Table 14, hard disk drives offer the cheapest available storage on a cost-per-byte basis while offering rapid access times.

Fourteen-inch Winchester hard disks typically retail for at least $10,000, putting them beyond the scope of this study. Eight-inch mini-Winchester drives presently retail for at least $4500; 5¼-inch micro-Winchesters retail for about $3500. It can be expected that 5¼-inch Winchesters, with current storage capacities between 3 and 13 megabytes, will offer serious competition to larger floppy disk units.

Some micro-Winchesters are being designed in the same size and with the same voltages as 5¼-inch minifloppies, allowing a minifloppy drive to be replaced by a micro-Winchester hard disk with only a change in the controller. These same attempts toward drive interchangability also make it easier for a microcomputer manufacturer to change from floppy to hard disk drives by changes only in internal system components rather than in the cabinet.

Bubble Memory

Although bubble memory has been heralded as the wave of the future since the mid-1970s, it has not met with great success.

Unlike semiconductor memories, which store their data electrically, bubble memories produce a series of tiny magnetic dots that represent bits of data. The dots, similar in appearance to bubbles, are directed along pathways by a pulsating magnetic field. Bubble memory access times are faster than floppy or hard-disk technologies, and are also more reliable, because there are no moving parts. In addition, bubble memories offer the advantage of increased memory capacity over RAM memory. Unlike RAM memory, it is not volatile and thus does not lose data when power is turned off.

Bubble memory advances have lagged behind both semiconductor memory and disk storage. With rapidly falling disk and semiconductor storage costs, bubble memory manufacturers were not able to establish the initial demand for their products that would allow them to generate revenues for further research. As a result, rotating disk and semiconductor technologies have made large advances, while bubble memory has not. The technology has, however, found important niches in industrial environments and portable computers.

Keyboards

Keyboards are based on a standard typewriter keyboard. They are the primary method of human input into the microcomputer, and are often combined with a cathode ray tube to create a display terminal. Keyboards range from a minimum 50 keys on consumer-grade models to over 100 keys on some commercial-grade models. A few consumer keyboards have used touch-sensitive keyboards in the past, generally without market acceptance. These keyboards have proven inadequate, due to the lack of tactile sensation when a key is depressed, as well as inability to withstand continued heavy use.

Video Display

A cathode ray tube (CRT) is the most typical method of data display for microcomputers. Low-priced CRTs are usually inexpensive television sets with a radio frequency (RF) modulator to convert the computer output to radio frequencies. More expensive CRTs usually display more information with higher resolution, and some have color capacity. Color is useful in educational and home environments due to its ability to create a stronger impression, and is finding increasing use in business

environments with the rise in popularity of color graphics.

CRT technology is not likely to be significantly displaced in the next five years by other technologies, such as flat panel displays, plasma displays, and liquid crystal displays (LCDs). These technologies, however, offer the promise of much smaller sizes due to decreased depth, fewer parts, and less heat generation.

The cost of displays, and particularly terminals, will continue to fall in the next five years as production levels increase and learning curve experience accrues. It is likely, however, that the user will select a more powerful display or terminal in coming years, for a price comparable to today's terminal, rather than a terminal with functions comparable to today's at a lesser price.

Computer Graphics

Although an increasing number of microcomputers employ graphics, good economical hard-copy graphics have yet to be introduced for microcomputers. Businesses are becoming increasingly aware of the advantages of business graphics, particularly in trend analysis, and prices are decreasing as volume and market potential increases. In general, graphics enable the user to interpret and assimilate numerical information much more quickly than tables of figures, and as a result are often a desirable product feature for a microcomputer designed to be sold into a business environment.

Printers

Many microcomputers are initially purchased without printers, particularly in the lower-price groups and in home or industrial applications. Usually, however, except for industrial applications, a printer is purchased at some point. Printers are used to generate hard copies of data, text, and program listings. Microcomputer printers are typically character-at-a-time serial printers, as opposed to higher-speed line-at-a-time printers.

Several types of serial printers are used with microcomputers. Electrosensitive and thermal printers are described as nonimpact printers. These printers retail for $200 to $600, and are usually used where copy quality and

speed are not important, such as in many home and classroom educational applications.

Dot matrix and daisy wheel printers are characterized as impact printers. Dot matrix printers, unlike thermal printers, allow for multiple copies on plain paper. Dot matrix printers retail for as little as $200, range in speed from 50 to 150 characters per second, and are used by the majority of microcomputers.

Daisy wheel printers are used for applications requiring full-character typewriter-quality output, typically in a word processing environment. Prices range from $1200 to $3400.

Printer prices are a function of speed, quality of print copy, reliability, noise levels, interface capabilities, and number of printed columns. With manufacturer learning curve experience and continued market demand, printers are likely to continue to increase in speed and reliability and decrease moderately in price.

SOFTWARE

Software is the set of programs and instructions that allows the microprocessor to solve problems. Microcomputer users eventually can expect to spend as much for software and software development as for microcomputer hardware, at least for non-home applications.

Software can be divided into two categories: systems software and applications software. Systems software consists of programming languages, operating systems for the control of peripherals and file management, and system controls for loading, assembling, editing, and testing programs. Applications software consists of programs that typically allow the user to make the microcomputer perform some function or computation. Examples include budget, payroll, word processing, computer assisted instruction (CAI) lessons, and games.

Languages

Four programming levels exist on most microcomputer systems: (1) machine languages, (2) assembly languages, (3) high-level languages, and (4) special language codes. When computers were first developed, machine language was the method of programming. Assembly language, invented years later, is more symbolic and powerful than machine language.

Many types of high-level languages have been developed. The presently available languages for popular microprocessors are:

* ALGOL
* APL
* BASIC
* C
* COBOL
* FORTH
* FORTRAN IV
* FORTRAN 77

* LISP
* MUMPS
* PASCAL
* PILOT
* PL/1
* RPG II
* LOGO

Operating Systems

Operating systems control the microcomputer, scheduling microprocessor use, and dealing with input from and output to peripheral devices (i.e., disk drives, printers, and terminals). The operating system allocates processor time, memory space, input/output devices, and file resources by keeping track of available resources and prioritizing their use.

CP/M (Control Program for Microcomputers) is the most popular microcomputer operating system, marketed by Digital Research, and licensed to many hardware manufacturers. Major home computer manufacturers, such as Atari (400, 800), Commodore (VIC-20), Radio Shack (Color Computer), Texas Instruments (99/4A), as well as Apple, have their own proprietary operating systems. Because of this, application software must be designed for specific products and is not compatible among vendors. Apple and Radio Shack, however, have the capability of being CP/M compatible with the addition of a $350 softcard, thereby enlarging their potential software base. CP/M86 is an enhanced version of CP/M for the 16-bit Intel 8086 microprocessor. CP/M86 allows easy software conversion at the operating system level, and will make it much easier for manufacturers to upgrade CP/M-based Z-80 microcomputers to the 16-bit 8086.

Bell Laboratories' UNIX is also a likely contender for 16-bit microcomputer operating systems. The large existing software base of UNIX-compatible programs written at universities may add to its attractiveness, particularly for scientific and business-computing applications.

Programs

Development of microcomputer applications software has substantially lagged behind that of microcomputer hardware.

Generally acceptable applications programs are now available for word processing and accounting applications. Yet, relatively few full-industry packages exist (e.g., for law, medical, or dental office management), or for small business management in a myriad of fields. Educational software, particularly in (CAI), is woefully inadequate. The specifics of the application software industry are elaborated more fully in the Industry chapter.

FUTURE TECHNOLOGY TRENDS

Hardware improvements will continue. In the next five years, 16-bit microprocessors will become commonplace in microcomputers. Microprocessor speeds will also continue to increase. By 1986, very large-scale integration should have reduced the 120-component microprocessor circuit board of today to one single chip.

Memory speeds and capacities will also increase, and the 200-component 64K-byte RAM memory board of 1981 will also likely be a single chip by 1986. Floppy and hard disk drive capacities will increase substantially as changes come about in the recording media as well as the read/write heads. Terminals will become more sophisticated, with better graphics capabilities as well as split-screen options.

Local computer network applications will expand rapidly. Many offices and major corporations will use microcomputers as part of a large information-processing system. Videotex information services will allow the consumer to access large databases from home, and to conduct electronic banking and possibly retail purchasing.

Software will become more powerful and easier to use. Higher-performance microprocessors will allow software to be written for larger applications, and will allow presently written software to be "translated" without tedious manual reprogramming for different microcomputers and microprocessors.

Competition

Competition within the computer home software market is becoming increasingly fierce. Prior to 1982 there were less than 200,000 computers installed within homes. These computers were primarily provided with the software produced or licensed by the hardware vendor of each respective system. As shipments of computers for home use increased in 1981 and 1982, many small entrepreneurial software firms entered the growing market. Many of these firms have already succeeded in acquiring a sales revenue in 1982 of over several million dollars.

In 1982, software sales (by both hardware vendors and independent software companies) generated wholesale revenues of $101.85 million. The 45+ percent markup (from wholesaler through distributor through retailer) accounts for the difference between this revenue number and the retail revenue amount of $190+ million for 1982, presented in the Market chapter of this study.

Focusing on wholesale software earnings, hardware vendors accounted for 39 percent, of $39.8 million, while software companies accounted for 61 percent revenue, or $62.05 million.

MARKET SHARE ANALYSIS

Software vendors will gradually increase their market percentage as more companies -- especially large corporations, such as CBS, Warner (with Warner software), Dow-Jones, etc. -- enter the market. At the same time, software-only stores will increase in popularity as distribution channels for software firms. By 1987, independent software companies are expected to have 64 percent of computer home software wholesale revenue, with hardware vendors reducing market share to 36 percent (see Table 15).

In Figure 10, hardware vendor revenue is divided according to hardware vendors who distribute software -- excluding Sinclair and IBM. Tandy, by maintaining such a large installed base of TRS-80 and producing 75 percent of its software internally, accounts for the largest percentage of the wholesale revenue pie. On the other hand, Commodore ended up with the smallest market share since:

* Few Commodore machines were installed in the home prior to the 1982 large selling of VIC-20s. Therefore, with a lower installed base, less software units were sold in 1982.

* Only 15 percent of Commodore's software is produced internally.

* The wholesale price of Commodore's software products is less than that of most other hardware vendor's software products.

Of the independent software companies, the larger (over $500,000 revenue per year) companies account for about 68 percent of the wholesale revenue from software companies, with $42.05 million (see Figure 11). Smaller companies, with about $20 million in revenue in 1982, accounted for 32 percent of software company revenue by larger software companies. (See the independent software vendor profiles later in this chapter.)

Although early computer home software vendors were able to successfully penetrate the software market (with a popular game or program distributed by mail, often initially with photocopied documentation), as competition increases, some

TABLE 15
COMPUTER HOME SOFTWARE MARKET VENDORS
(Percentage of U.S. CHS Market Wholesale Revenues)

	1982	1983	1984	1985	1986	1987
Hardware Vendors	39%	38.5%	37.5%	37%	36.5%	36%
Software Companies	61%	61.5%	62.5%	63%	63.5%	64%

Source: Creative Strategies International

FIGURE 10
REVENUE SEGMENTATION BY H/W VENDORS
1982

Total Wholesale Revenue $39.8 M

41%
Tandy
($16.3 M)

22%
Atari
($8.6 M)

25%
TI
($10.2 M)

7%
Apple
($2.8 M)

5%
Commodore
($1.9 M)
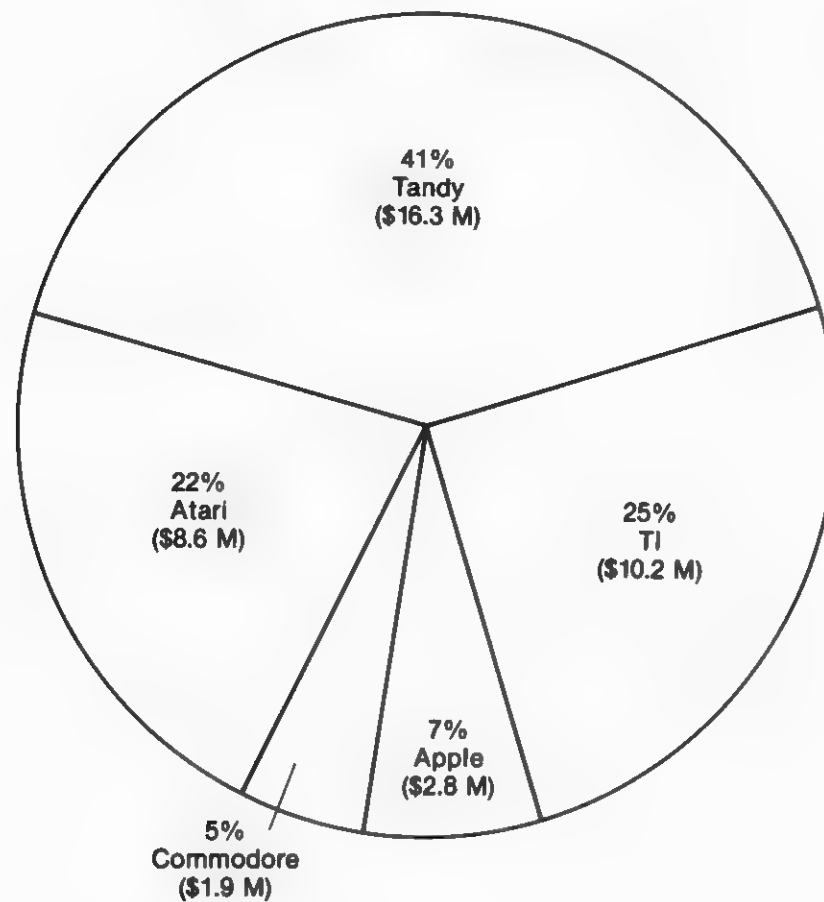
Source: Creative Strategies International

FIGURE 11
1982 WHOLESALE S/W REVENUE
SEGMENTATION BY S/W COMPANIES–
SMALLER VS. LARGER

Larger S/W
Companies
$42.05 M

Smaller S/W
Companies
$20 M
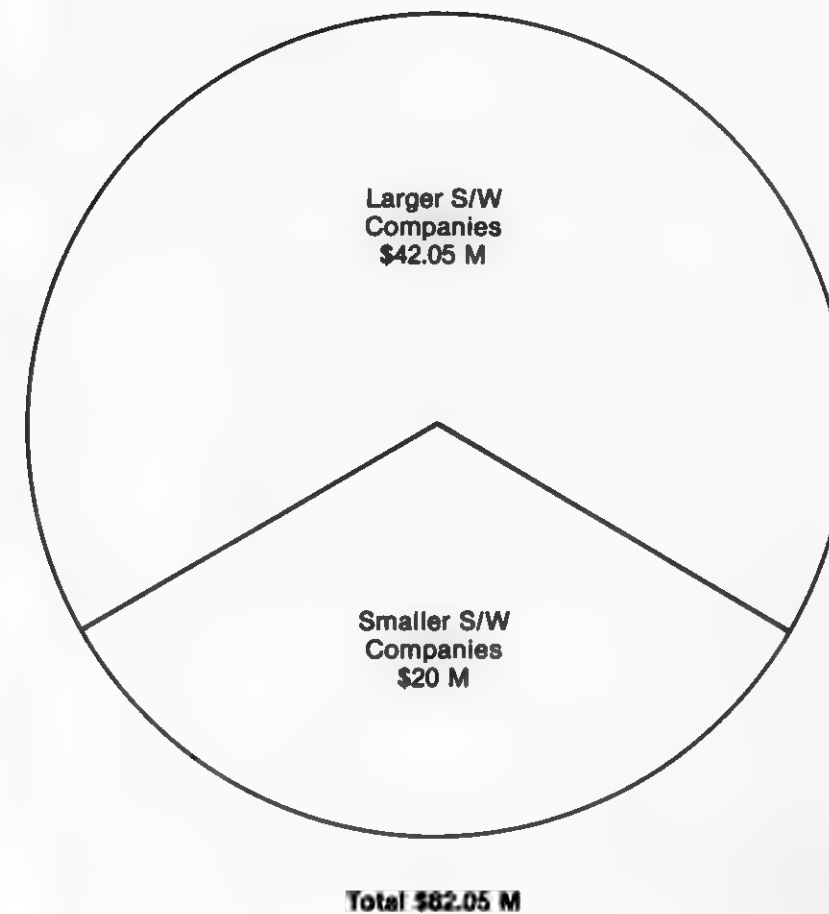
Total $62.05 M

Source: Creative Strategies International

type of market strategy will be needed. All computer home software vendors will need to:

* Use capital wisely
* Offer quality, easy-to-use software
* Create strong marketing capabilities
* Employ successful distribution channels
* Maintain a good customer support system

THREAT OF POTENTIAL ENTRANTS

Large Corporations

As the home software market grows, large corporations, especially those from the broadcasting and publishing industries, will enter the field. Firms, such as major movie studios (some are already involved in the video game software business), are another group who will soon make advances into the home software market, especially in the entertainment area. Movie firms bring great market ability and expertise to the field, as well as ready-made sources for computer games via their movie main characters (e.g., E.T., licensed to Atari) or existing animated characters. These large companies will create additional barriers for lesser-known and start-up computer home software companies, due to the following advantages:

* Name recognition
* Availability of advertising funds
* Technical and marketing expertise
* Knowledge of distribution channels

Later, cable TV and other providers of electronic delivery systems will also compete with both software producers and distributors.

Video Game Cartridge Manufacturers

Video game hardware sales totaled over $8 million in 1982. Sales of related software, specifically cartridges, surpassed $1 billion that same year. However, both hardware and software game vendors fear that because of price decreases of home computers, the video game market may be saturated.

At least three independent software developers for home games systems are developing software for home computers in 1983 -- Activision, Imagic, and Parker Brothers. All three vendors have promised early- to mid-1983 initial shipments for home computer software, and will begin by supplying products for the Atari 400 and 800 and VIC-20, with later plans to develop programs for the TI 99/4A.

Video game system manufacturers will also be competitors in the computer home software marketplace in yet another way. Companies such as Coleco, Mattel, and Odessey have introduced adaptors to their game consoles that can "upgrade" the system to a computer. These vendors, as well as other independents, will provide software for these systems. This competition will, therefore, affect both home computer manufacturers as well as software providers.

Japanese Competition

Besides competition for present computer home software vendors by new entrants from large U.S. firms, new competition will soon also come from abroad -- especially Japan.

Japanese companies will make major inroads in all areas of the U.S. computer industry -- especially in the area of personal computers. The Japanese computer market is growing at 25 percent per year. The exporting of computers is growing, too. In 1979, 8 percent of Japanese computer products were exported; this export rate increases at 30 percent annually. The Japanese electronics companies set a national goal of winning close to 20 percent of the U.S. computer business and a 30 percent share of worldwide sales by 1990. The personal computer industry is one of the main markets they plan to target. To aid their penetration of the market, low-cost, quality software will accompany their products.

Japan's reputation for high-quality, low-cost consumer electronic products is due to:

* Fierce competition among Japanese companies

* Vertically integrated companies (i.e., low cost for such components as semiconductors and keyboards)

* High priority for funding research and development

* Worker and management familial relationships, resulting in pride in quality products.

Japan's strategy for the entire computer market is to start at the low end of the product spectrum and establish familiar brand names and a reputation for excellence. In this case, the low-end products are consumer products, such as personal computers, peripherals, and printers. Next, the Japanese computer vendors will market the subsequent level of electronics products (i.e., small business computers and so on up to large mainframes) to these already satisfied end users.

Besides offering quality low-cost products, the Japanese expect to excel in the personal computer market because of their distribution channels. Since most major vendors have had great success selling TVs, radios, VTRs, and other consumer electronic products, personal computer vendors plan to distribute through similar methods -- mainly through department stores and other nonspecialized stores. This channel is very cost efficient and will attract many nontechnical and nonprofessional potential buyers.

Sharp, Casio, Epson, and Matsushita already have entered the handheld computer market, and Sanyo is entering the portable keyboard console market in Europe. NEC Home Electronics (USA) is expected to introduce its new low-end computer system to the United States momentarily. The basic PC6000 system, priced under $500, will attach to a standard TV. The system contains 16K bytes of RAM and 16K bytes of ROM, expandable to 32K, featuring a version of Microsoft BASIC, and will offer any number of peripheral attachments.

Panasonic, a division of Matsushita, entered the low-end home computer market in January 1983. The product is sold to resemble a similar product Matsushita currently sells in Japan. Along with the unveiling of the computer, Panasonic also plans to announce the forty to fifty already-developed packages to support the system. Most other large Japanese companies are known to be working on low-cost personal computers, some already being marketed in Japan. The firms are:

* Hitachi
* NEC

* TRW/Fujitsu
* Oki
* Sord
* Sony

Computer manufacturers in the United States insist that Japan will not reach its goals because it lacks quality software. This may be the case for larger computer systems; but for personal computers with the standardized CP/M operating system, an enormous number of interchangable software packages are readily available from other vendors. Few computers in the home use CP/M; however, by 1985, many computers in the home will be designed to accommodate CP/M or will offer compatibility by use of an emulator. Also, some independent software companies are emerging in Japan to produce application packages especially for personal computers. There are already 2000 application packages available for Japanese computer owners, and by 1985, close close to 12,000 are expected. The Japanese already lead the United States in games. The Japanese enjoy an intense video game culture (as does the United States), but graduated from space games to other more comic game entertainment a year or two before the United States. Space Invaders was of Japanese design, as was Pac-Man (by Taito Inc., licensed to Atari for U.S. sale), the first major nonaggressive video game. The current popular comic arcade and video games of Donkey Kong and Crazy Climber were designed in Japan, distributed and manufactured in the United States by licensing agreements.

Creative Strategies International expects Japanese companies to successfully enter the home computer market segment and to gain and maintain significant market share. In some cases, the Japanese company may be the parent of the U.S. distributor (as Matsushita is the parent company of both Panasonic and Quasar) or the designer of an American retail company's product (as Sharp was the designer of the Radio Shack handheld computer). Whatever market strategies the Japanese manufacturers utilize, their products should be well received.

Ultimately, the influx of Japanese personal computers will prove highly positive both for consumers and U.S. manufacturers. Greater end-user awareness generated by the sale of any good quality product results in additional sales in that field as a whole. With Japan's quality products and consumer marketing skills, present and potential personal computer vendors and software designers may advance their market shares. Consequently, consumers will be offered

better, lower-priced products from both Japanese and U.S. vendors.

1982 COMPUTER HOME SOFTWARE COMPETITORS

The two types of competitors for computer home software are hardware vendors and software-only companies. Competitive profiles will be provided for major hardware vendors. Timex/Sinclair will be included in the profiles, even though at present no software is produced internally, since with the addition of the Spectrum (with its mini disk drive), the company is expected to begin software design in 1983.

Of the hardware vendors who supply computer home software, all have differing concentrations of sales from the three major computer home software market segments -- entertainment, home management, and education (see Table 16). These percentages affect hardware vendor revenues since, in general, the more home management packages a vendor sells (at generally a higher AUP than the entertainment and educational packages), the more revenue for a company.

Software-only vendors are more difficult to profile. There are now hundreds of mostly small companies that produce computer home software. Therefore the top 15 (in terms of revenue) independent software producers of computer home software will be briefly profiled. Vendor comparisons will be made according to revenue received from:

* Computer home software market as a whole
* Computer home software entertainment as a whole
* Computer home software education as a whole
* Computer home software home management as a whole

The smaller software companies are included in the Other category, which comprises 32 percent of software revenue by independent companies.

TABLE 16

1982 HARDWARE VENDOR SOFTWARE SHIPMENTS AS PERCENTAGES OF COMPUTER HOME SOFTWARE MARKETS

Company	Entertainment	Home Management	Education
Apple	30%	40%	30%
Atari	80	10	10
Commodore	40	30	30
Tandy	50	30	20
Other	40	20	40

Source: Creative Strategies International

Hardware Companies

Apple Computer, Inc.
10260 Bandley Drive
Cupertino, California 95014
(408) 996-1010

Apple was founded in 1976 as a partnership between Steven Jobs and Stephen Wozniak. In 1977, it was incorporated and shipped its first computer. Since then, Apple has become the largest and most recognizable of the microcomputer manufacturers. In 1982, Apple shipped about 335,000 microcomputers, with revenues totaling over $900 million.

In 1976, the two founders of Apple designed and constructed the Apple I, a single-board microcomputer. In April 1977, Apple introduced the Apple II, with additional circuitry and a keyboard housed in an enclosure. During 1978 and 1979, floppy disk mass storage was improved for the Apple II, increasing its capabilities as well as facilitating the development of applications software. Independent firms began to supply a wide variety of applications software and peripheral equipment for use with the Apple II. As a result, Apple now enjoys the largest base of available software for many applications, making the product attractive to the potential purchaser.

In November 1980, Apple began shipping the Apple III, which was basically an upgrade of the Apple II. The Apple III had early reliability problems and was sometimes not compatible with Apple II software. This, combined with a relatively high price, caused many buyers to be very skeptical of the Apple III and tarnished Apple's generally high reputation. During 1981, Apple cut the price of Apple III by $500 in response to slow sales and the introduction of the IBM Personal Computer. In 1982, Apple cut the price of its system over 15 percent by bundling products.

Apple offers a variety of software. Programming languages include BASIC, FORTRAN, PASCAL, and PILOT. The operating system is specific to the Apple II, with the Apple III employing a different system. Principal applications packages include Apple Post (a mailing list program), Apple Writer (word processing), Dow-Jones Series Portfolio Evaluator, Shell Games (educational programs), Apple Plot (graphics), and Controller (accounting), as well as a vast library of entertainment packages. Apple Plot, Apple Writer, and Controller were developed by independent vendors and are marketed by Apple under a royalty agreement. In addition to the above programs, many Apples also come with VisiCalc, from Personal Software.

Apple's greatest selling strength lies in third-party software that provides uses for its hardware. From its inception, Apple promoted third-party software development, and cooperated with developers by supplying proprietary information about their computers. Most applications software was developed by hobbyist end users who found little software originally available. According to Apple, there are over 170 small third-party software companies that produce Apple-compatible software packages. In addition, about one-third of Apple dealers in the United States have employed programmers to develop custom software.

In general, Apple is more involved with the preparation of good documentation manuals for systems software than with applications program development. However, the company does try to make effective software available through support of independent software development, and does not rely on OEMs to provide value-added software products for its systems. Apple is most interested in pursuing management-oriented software. In December 1981, Apple also formed a software market development program to work with publishing concerns to develop and market educational software.

In late 1982, Apple announced that through an agreement with the Childrens Television Workshop (a subsidiary of the Childrens Television Network which created Sesame Street), home educational software was developed for the Apple II, using the well-known Sesame Street characters, to be sold through Apple dealers.

Apple products are sold in the United States and Canada by approximately 950 independent retailers. Apple also markets its products to end users and OEMs through its own direct sales force and through independent sales representatives. In December 1981, Apple began test marketing its products at a department store for the first time. Some Macy's stores now carry Apples. Presently, IBM and Osborne are beginning to severely cut into Apple's distribution system.

Prior to August 1980, non-U.S. sales were made primarily to an independent distributor, Eurapple. Eurapple distributed to Europe, the Far East, the Middle East, Australia, the Philippines, and South Africa. In August 1980, Apple acquired

Eurapple's distribution rights. It currently sells its products to about 30 independent non-U.S. distributors through two distribution centers.

Non-U.S. and Canadian sales account for approximately 17 percent of revenue. Total non-U.S. sales, including Canada, amount to approximately 29 percent of revenue. Approximately 1300 dealers carry Apple products outside the United States and Canada.

In January of 1983, Apple replaced the Apple II with a new enhanced version, called the IIe. The IIe is also based on the 6502 microprocessor, with a simple motherboard (due to use of custom large-scale integration (LSI) chips). It offers up to 128K bytes of RAM. Software is compatible with the Apple II. Apple will also introduce a portable microcomputer to counter expected heavy competition by Osborne. The product will be based on either the 6502 or the 68000 microprocessor and will offer 128K bytes of RAM. A battery-pack will also be available.

As previously mentioned, Apple's strengths include a well-regarded product, past sound management, and a very large software base. Significant weaknesses include high vulnerability to competition, a shaky distribution system as previously described, and an incomplete product line. The Apple III failed, because of its reliability problems, software compatability problems, and inflated price. Apple does not have an adequate low-end product to compete with the Atari 400, the Commodore VIC-20, and the Radio Shack Color Computer. Apple has not addressed the home market directly in several years, but has emphasized business and educational applications instead. The educational market generally restricted by tight budget constraints, is inclined to purchase these lower end products as they become available, particularly for the lower grade levels. As Atari has demonstrated, the home market and the education market in the lower grades can be effectively segmented from the business market by minor product modifications. As a result, Atari has in fact significantly affected Apple's sales to education.

Apple has been the success story of the microcomputer market, partially as a result of maintaining high visibility. But that success and visibility has caught the eye of major corporations. As a result, the IBM Personal Computer is targeted directly at the Apple II, although the IBM is technically superior. Software producers prefer the IBM to the Apple II. The Xerox 820 computer is targeted just above the Apple II and below the Apple III. Xerox, in fact, calls the 820 "The Worm," a tongue-in-cheek slap at Apple, although the significance of the name has been lost by many. Several Japanese companies are offering or planning products which are Apple II look-alikes. All of these companies offer standardized operating systems to assure software availability. IBM and Xerox have substantial direct sales forces and service networks. As a result, Apple will be substantially affected by competition. Apple faces major challenges in the next few years. To retain the image of success it has generated in the past Apple is meeting the competition by:

* Upgrading the Apple II

* Introducing the Lisa workstation

* Introducing the Macintosh in mid-1983

Table 17 lists the major independent software companies and their revenue in 1982 from Apple software.

Atari, Inc.
1265 Borregas Avenue
Sunnyvale, California 94086
(408) 745-2000

In 1976, Warner Communications purchased Atari. Warner's main focus is the entertainment industry, including recorded music and music publishing, motion pictures and television, cable communications, toys, electronic games, and sports. Revenues for 1982 exceeded $4 billion. Warner has provided significant financial support to Atari and hopes to move strongly into the home market and tie together its assorted video, cable, and entertainment operations. Already, in 1982, Atari accounted for over half of Warner's total revenues.

Atari's home video games had been the unquestioned leaders in that market, accounting for about two-thirds of Atari's 1982 revenue. Video games remain an expanding area of profitability for Atari, and the company has continued to introduce new games for its system. In late 1979, Atari introduced two personal computer systems, the 400 and the 800. Atari expected these products to do very well, using extensive advertising to promote them. Advertising focused on user friendliness and ease of operation for people who are not computer literate, while attracting the more advanced

TABLE 17

MAJOR INDEPENDENT SOFTWARE COMPANIES, 1982 REVENUES FROM APPLE SOFTWARE PRODUCTS
(Millions of Dollars)

Company	Entertainment	Home Management	Education
Sierra On-line, Inc.	$3.6	$1.8	$ .09
Sirius	4.0	—	—
Broderbund	1.9	.08	.09
Continental	—	2.4	—
Automated Simulations/EPYX	1.2	—	—
Datamost	1.4	.13	—
Hayden	1.1	.20	.10
Muse	.9	.30	—
Sir-Tech	1.0	—	—
Lightning	—	—	.70
Edu-Ware	—	—	.70
Softsync	—	—	—
Spinnaker	—	—	.32
LJK	—	.10	—
Cavalier	.3	—	—
Software Publishing	—	.40	—
Howard	—	.36	—

Source: Creative Strategies International

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user by describing programmability and the more sophisticated equipment and peripherals.

Because of Atari's "game" background, much of the software currently available from Atari comes in the form of program cartridges. Atari also offers some of the fastest and most powerful graphics-animation software in the business.

Initially, advertising and sales campaigns were poorly focused, and Atari's secretive attitude toward its products' specifications thwarted third-party software development. Finally, however, the company directed its advertising to the home and education market and released its product specifications. Over 45,000 units were sold in 1980, and 160,000 in 1981. Product mix shifted toward the Atari 400, following a major price cut from $630 to $399 in early 1981. Slightly more than 50 percent of all Atari units sold are now the 400 model. Atari reduced the price of the 800 model by 12 percent at the end of 1981. Further price reductions on both models occurred in 1982. By September the 800 could be purchased for $700, while the 400 could be purchased for $270, pieced with $150 worth of software. This was in direct response to TI's $100 rebate offer for its 99/4, which priced the TI machine after rebate at $199. In early 1983, Atari released a 1200 model, and a 400 which will include a standard keyboard (replacing the 400's Mylar version). In late 1983 to early 1984, Atari is also expected to introduce a 16-bit personal computer. By the beginning of 1983, the 400 was discounted to $400.

Unlike most other manufacturers of microcomputers, Atari is making a major push into the home market. In December 1981, Atari renamed its computer operations group the "Home Computer" division. Atari sees its major markets as the home, education, and professionals in a home environment. Atari believes the home market will greatly expand because of easier-to-use computers and better home software. By cutting the price of the 400 model, and launching a multimillion dollar advertising campaign targeted at the consumer market, Atari increased its market share in 1982.

Today, the educational market accounts for 22 percent of all Atari sales, consisting largely of 400 models. The 400's low price has attracted many educational users to Atari. The firm has made substantial sales in 1982 through agreements with the Minnesota Educational Computing Consortium (MECC), formerly a major client for Apple. MECC is a joint power

agency that provides educational computing services and acts as a central purchaser for Minnesota school districts. Atari offered a package deal for $580 through its dealers for an Atari 400 with 16K bytes RAM, a disk drive, BASIC language cartridge, joystick controller, and black-and-white monitor. Atari expected to sell at least 750 computers to Minnesota schools in 1982. In mid-1982 Atari was awarded a $13 million contract with the Department of Defense (DOD) to supply Atari 800 hardware, software, support, and maintenance over a five-year period for use in DOD school systems for dependents of DOD personnel overseas. Atari believes the educational market is an advantageous channel for entry into the home market. They reason that students using an Atari at school will influence their parents when purchasing one for the home. To encourage educational sales, Atari has tried such ploys as a 30-day trial offer, realizing schools will be hard-pressed to return them. Atari has also tried Commodore's three for two deal, giving one 400 model free for every two units sold to schools.

Science Research Associates (SRA), a subsidiary of IBM, acts as a nonexclusive distributor for Atari in the educational market. SRA, which has offered individualized instruction packages to schools since 1957, offers courseware for Atari products in mathematics, reading, and English. Emphasis is on lower grade levels. SRA has a staff of 100 sales representatives who hold seminars and give demonstrations. SRA supports its products with direct mailings, catalogs, and advertising in educational periodicals.

Atari products are sold principally in the United States, although markets in other countries are being addressed. Atari products are carried by some major computer stores but more widely by mass merchandisers such as Macy's and Sears as well as discount stores such as K-Mart. Atari's emphasis on the educational and home markets, and its distribution to conventional retail stores have caused many dealers to shift to products offered by IBM, Osborne, or Xerox.

Atari has made major efforts to develop software for its products, providing a quarterly catalog of all programs available from various sources for its computers. The catalog (about 60 pages long) is called the Atari Program Exchange (APX) and describes third-party programs as well as rating them in terms of good documentation, ease of use, and value to user. But the company does little to promote this catalog or any other method of acquiring software not part of Atari's

main product line. Supposedly the purchaser of a 400 or 800 system receives software information after the warranty card is mailed. Yet the importance of returning the card is not stressed. Users who do not return the warranty cards are left to their own devices to discover third-party software (from magazines or specialized stores). More than likely, these users will purchase from Atari's "main product line" (which includes about 40 packages), of which may be distributed by the same vendor that sells the hardware system. In April 1981, Atari announced it would establish regional software acquisition centers for software development. The centers were to be located in major metropolitan areas and near technical universities. The centers are equipped with Atari computers, and reference and technical manuals. Experts are available to answer questions. Technical seminars also help familiarize authors with the technical aspects of the computers.

Atari's strengths include a familiarity with mass production, a widely recognized name, and heavy financial support from Warner. Weaknesses include an incomplete distribution system and a "toy" image.

Table 18 lists the major independent software companies and their 1982 revenue from Atari software.

Commodore International Limited
Computer Systems Division
950 Rittenhouse Road
Norristown, Pennsylvania 19406
(215) 337-7100

Commodore shipped over 400,000 microcomputers in 1982, resulting in revenues of over $400 million. Fifty-three percent of these units were sold outside the United States. The Commodore microcomputer line includes the VIC-20, PET, CBM, SuperPET, and the new Commodore 64. Presently the majority of Commodore computers in the home are VIC-20s and a small percentage of PETs.

Commodore's product line includes microcomputers, consumer products, and electronic components. In November 1976, the company acquired MOS Technology, manufacturer of the 6502 processor used in the Commodore VIC-20 and PET/CBM models. The same processor is used in Apple, Atari, and Ohio Scientific computers, although commonly purchased from second-source manufacturers like Synertek.

TABLE 18

MAJOR INDEPENDENT SOFTWARE COMPANIES,
1982 REVENUES FROM ATARI SOFTWARE PRODUCTS
(Millions of Dollars)

Company	Entertainment	Home Management	Education
Sierra On-line, Inc.	$3.6	$ —	$ —
Sirius	4.0	—	—
Broderbund	2.7	.08	.15
Continental	—	—	—
Automated Simulations/EPYX	1.2	—	—
Datamost	—	—	—
Hayden	—	—	—
Muse	—	—	—
Sir-Tech	—	—	—
Lightning	—	—	—
Edu-Ware	—	—	.30
Softsync	—	—	—
Spinnaker	—	—	.32
LJK	—	.15	—
Cavalier	.2	—	—
Software Publishing	—	—	—
Howard	—	—	—

Source: Creative Strategies International

Introduced in the mid-1970s, the original PET had a limited keyboard, cassette tape storage, and a black-and-white CRT in one enclosure. The unit was promoted heavily for the home and for schools. In 1979, Commodore began to offer a redesigned unit with better capabilities. That unit became known as the PET and the CBM. The PET models are available with 8K, 16K or 32K bytes of RAM and a 40-column display. The CBM models are available with 32K or 96K of bytes RAM and an 80-column screen.

Four more recent units have been offered by Commodore. The VIC-20 is a color computer with 5K bytes of RAM, expandable to 32K. The VIC-20, priced at less than $200, is targeted heavily for home and educational applications. It competes against the Radio Shack Color Computer and the Atari 400. The VIC-20 is sold through mass merchandisers and computer dealers. Initial sales of the VIC-20 lagged due to the lack of available cartridge software and peripheral devices such as disk drives, printers, and modems. Commodore has since added a wide variety of enhancements and software which support the VIC-20 in being a versatile, cost-effective home computer. The other unit is the Super PET for $1995. The computer supports BASIC, PASCAL, FORTRAN, APL, and COBOL. The VIC-20 is marketed by the Home Computer Sales group, while the other computers are marketed by the Professional Computer Sales group.

In late 1982, Commodore marketed two new computers. Its Ultimax is a 2K computer (expandable to 4K), with a flat keyboard and optional piano-style keyboard which allows the unit to function as a music synthesizer. The Ultimax is priced at around $150 and can use many of the VIC-20's peripherals. The Ultimax is presently selling very well in Japan, but in 1982, Commodore's marketing efforts were on the VIC-20, and therefore, the Ultimax sold marginally in the United States. The Commodore 64, priced around $600, must compete with higher-priced computers such as the Apple II and Atari 800. The unit contains 64K RAM and can display color graphics as well as 40-column text with the addition of a monitor. The Commodore 64 can also run CP/M, making available a wide variety of business applications software. In 1983,

Commodore is marketing a portable computer, the SX-100. Its two models include computer systems, with:

* A single-disk, black-and-white 5-inch monitor, priced at $995

* A double-disk color 5-inch monitor, priced at $1595

It will also drop the price of the 64, and introduce a 128.

Commodore does in-house software work for the VIC-20. The software department works directly with outside firms to provide technical assistance. A user magazine is published bimonthly.

Programs are available for games, education, and home. The available software for games is in cartridge form. The home management software consists of a series of five cassettes that can be purchased singly for $15 or together for $60. The home applications include:

* Personal finance
* Home budget
* Home inventory
* Expense calendar
* Loan and mortgage

The home software available for the VIC-20 is not nearly as plentiful as that for Radio Shack, Apple, and Atari. Few third-party software manufacturers in 1982 produced and sold programs for Commodore. However, Commodore's philosophy is "produce a large machine installed base and people will write software for it." This strategy seems sound, since now that the VIC-20 has the largest installed base of home computers, major software companies are planning design of Commodore software in 1983.

Commodore has 650 dealers in the United States; dealer margins are 30 percent. The majority of VIC-20s, however, are sold by mass merchandisers. In the past, educational sales accounted for about one-third of Commodore's U.S. sales prior to 1982. Recently, however, schools have hesitated to buy Commodore products because of a lack of educational software, poor service and support. In 1983, with more Commodore software support as well as more quality educational software packages for all vendors, this resistance will decrease.

Table 19 lists the major independent software companies, their 1982 revenue from Commodore software.

IBM

Information Systems Division
Entry Systems Business
P.O. Box 1328
Boca Raton, FL 33432
(305) 998-2000

In August 1981, IBM announced its entry into the low-priced microcomputer segment, which it dubbed simply the Personal Computer. In its basic configuration, the 16 bit system retails for $1565. In this configuration, a cassette recorder is used for mass storage and a television set as a video monitor. A system with a 5¼-inch, 160K byte floppy disk drive and 64K bytes of RAM retails for $3005. A more sophisticated system with two floppy disk drives, color graphics, and an Epson MX-80 dot matrix printer sells for $4500.

Three operating systems are available: CP/M-86 from Digital Research, Softech's UCSDp-System, and IBM PC Disk Operating System (DOS). The PC-DOS was developed by Microsoft and is similar to CP/M. Available languages include Microsoft BASIC on cassette or floppy disk, and Microsoft PASCAL.

IBM is also establishing its own Personal Computer Software Publishing Department. The department will solicit software from outside authors as well as encourage its employees to write software on their own time. Compensation will consist of quarterly royalty on actual sales.

Retail distribution is handled through Sears computer stores and IBM Product Center retail stores, both in their infancy, as well as through the ComputerLand chain and some Macy's stores.

The Personal Computer marks a change in attitude for IBM. The microcomputer market was gaining momentum before IBM entered, just as the minicomputer market had years before. Unwilling to allow firms like Apple, Tandy, and Commodore establish a sure footing in microcomputers (as Digital Equipment, Data General, Hewlett-Packard, and others had in minicomputers), IBM was forced to move quickly into the microcomputer market. As a result, IBM entered with a product with substantial non-IBM content. The microprocessor,

TABLE 19

MAJOR INDEPENDENT SOFTWARE COMPANIES,
1982 REVENUES FROM COMMODORE SOFTWARE PRODUCTS
(Millions of Dollars)

Company	Entertainment	Home Management	Education
Sierra On-line, Inc.	$ .5	$ —	$ —
Sirius	—	—	—
Broderbund	.1	—	.6
Continental	—	—	—
Automated Simulations/EPYX	.3	—	—
Datamost	—	—	—
Hayden	—	—	—
Muse	—	—	—
Sir-Tech	—	—	—
Lightning	—	—	—
Edu-Ware	—	—	—
Softsync	—	—	—
Spinnaker	—	—	—
LJK	—	—	—
Cavalier	—	—	—
Software Publishing	—	—	—
Howard	—	—	—

Source: Creative Strategies International

the floppy disk drives, the video display unit, and the software were all produced outside IBM. Rather than provide a product that was not compatible with the rest of the market, IBM went to great lengths to ensure compatibility with existing software bases and peripherals. IBM, in fact, plans to release detailed specifications of the Personal Computer in order to allow software and peripherals to be produced rapidly. This rapid penetration strategy reflects its realization that software, distribution, and availability of peripherals are the keys to the microcomputer market. IBM does not have the capacity internally to meet the demands of the microcomputer market for diverse types of software. It has not had experience in mass retail sales. It could not afford to spend several more years in peripherals development (especially since several manufacturers already had substantial technical leads and economy of scale advantages). As a result of IBM's rapid penetration strategy, sales of the Personal Computer should increase rapidly. Sales of the IBM computer numbered approximately 10,000 units in 1981, totaling revenues of $19.5 million. During 1982, IBM's first full year of production, sales of the Personal Computer reached 180,000 units, producing revenues of $387 million (retail value of $595 million). During 1982, IBM suffered from production constraints, not meeting demand until 1983. The introduction of communications capabilities with larger IBM computers will also increase sales substantially. In 1983, IBM is expected to introduce a low-end microcomputer designed specifically to compete in the home market.

Although the vast majority of IBM Personal Computers are used for business purposes, there have been a significant number of entertainment and home management packages produced and sold for the machine by independent software vendors. This trend will continue in 1983 as the sales of the Personal Computer increase. Table 20 lists the major independent software companies and their revenue in 1982 from IBM software.

Sinclair Research Limited
One Sinclair Plaza
Nashua, NH 03061
(617) 367-2555

Sinclair Research Limited of Cambridge, England, was formed in September 1979 by Clive Sinclair, to conceive and develop new products. Sinclair claims to have introduced several technological innovations in the past, including the first pocket calculator, the first digital watch based on a

TABLE 20

MAJOR INDEPENDENT SOFTWARE COMPANIES, 1982 REVENUES FROM IBM SOFTWARE PRODUCTS
(Millions of Dollars)

Company	Entertainment	Home Management	Education
Sierra On-line, Inc.	$ .81	$ —	$ —
Sirius	—	—	—
Broderbund	.05	—	—
Continental	—	1.6	—
Automated Simulations/EPYX	.23	—	—
Datamost	.15	.13	—
Hayden	—	—	—
Muse	—	—	—
Sir-Tech	—	—	—
Lightning	—	—	—
Edu-Ware	—	—	—
Softsync	—	—	—
Spinnaker	—	—	.16
LJK	—	—	—
Cavalier	—	—	—
Software Publishing	—	—	—
Howard	—	.04	—

Source: Creative Strategies International

single chip, pocket televisions, and flat screen televisions. Nascent Pocket Television Company, Sinclair's business operation prior to Sinclair Research, went bankrupt in 1978.

Sinclair Research's first product was the 12-ounce ZX-80 microcomputer selling for $199.95. It was based on a Z-80A microprocessor running at 3.25 MHz, with 1K bytes of RAM and 4K bytes of ROM. It had a pressure-sensitive 40-key keyboard, and displayed 24 lines by 32 columns using a built-in RF modulator, permitting it to be attached to a home television. Options still available include an 8K-byte ROM BASIC module for about $40, and a 16K-byte RAM module for about $100. Sinclair intends to introduce a printer in early 1983 for under $100. Sinclair's present product is the ZX-81, which sold for $149.95 in 1982, an upgrade of the ZX-80 with a better display, more graphics, and more storage. Sinclair is able to produce such a low-priced product because it uses a total of only 22 standard integrated circuits, substantially less than most microcomputers. While this results in more limited capabilities, it is still comparable to the original Radio Shack TRS-80 Model I.

Although the ZX-81 is purchased primarily to teach BASIC, there are a number of peripherals and software available that connect the product to a more general and useful home computer. A cassette recorder is available (a minifloppy disk promised in the near future), as well as a ZX printer, and memory expansion module to 16K.

Prepackaged software includes tax computation, personal finance, education, graphics, and games. Although the ZX-81 is limited by lack of color and no sound, the available software packages are very innovative. The prinicipal supplier of Sinclair software is a New York company named Softsync. The mail order company (Softsync) began two years ago and now sells hundreds of software packages priced around $15 each per week, the majority being games. In late 1982, Softsync felt that it had saturated its business package market, so the firm licensed some of its business software to Timex, who has relabled the packages and is selling them in many cases where the ZX-81 is being sold.

The ZX-80 and ZX-81 were initially marketed through mail order in Europe and in the United States, as well as through British stationery stores. Timex now sells the ZX1000 for $1000 by mail to a potential of 9.5 million American Express credit card holders as well as to a large variety of mass

merchandisers. Sinclair sold over 300,000 units worldwide in 1981 (the United States accounts for about 25 percent of sales, in 1981). In 1982, sales were over 600,000 in the united States, with the balance in Great Britain and Continental Europe.

Tandy Corporation
Radio Shack Division
1800 One Tandy Center
Fort Worth, Texas 76102
(817) 390-3700

Tandy's revenues amounted to over $2.5 billion for the fiscal year ended June 30, 1982, During calendar year 1982, Tandy's Radio Shack division shipped over 300,000 microcomputers worldwide, resulting in revenues of over $400 million. Tandy produces a broad range of consumer electronic products, including stereo equipment, radios, tape recorders, electronic parts, toys, telephones and CB radios.

Radio Shack's primary strengths are in its retail marketing ability and in production economies of scale. Radio Shack has over 5000 company-owned stores and 3000 authorized dealers in the United States, and in 1982 started a new distribution chain -- the Radio Shack computer centers. These centers carry a variety of different vendor computer products. Presently, the company has over 200 stores in the United States and 50 internationally. Despite tough competition from ComputerLand and hundreds of independent computer stores, Tandy plans to open more stores in 1983.

Tandy also has begun distributing through mass merchandisers such as Sears in an effort to penetrate the home market.

Radio Shack also distributes its microcomputers through OEMs and system houses, generally configured with vertical market packages.

Radio Shack manufactures several microcomputers, including the Model II and Model III, as well as the Color Computer. Radio Shack's original product was the Model I, introduced in August 1977. The Model I was phased out at the end of 1980 in the United States, due to the extensive modification needed to meet Federal Communication Commission (FCC) RFI regulations. Instead, Radio Shack introduced the Model III, basically a Model I with metal shielding, and a new circuit board and plastic housing. The Model III lists

for $699 with 4K bytes of RAM, a 1.8-MHz Z-80 microprocessor, a 65-key keyboard, and a 64-column by 16-line display. The Model II is Radio Shack's business-oriented product. A 64K-byte RAM system with one 486K-byte 8-inch floppy disk drive retails for $3900. The Color Computer is Radio Shack's product oriented for the home and classroom education markets. In 1982, its sales were far below the number expected. This was primarily due to Radio Shack's late price reduction of the home product -- later than other vendors -- lack of mass merchandising outlets, and lack of major advertising campaigns. It is based on a 0.9-MHz 6809 microprocessor, has 4K bytes of RAM, a 53-key keyboard, and 32-column by 16-line display. Unlike other Radio Shack models, the CRT is not built-in; a home television with an RF modulator is used instead as a display. Retail price is under $300 for a 4K-byte RAM version.

In January 1982, Tandy introduced a microcomputer based on a 16-bit Motorola 68000 microprocessor. The system, selling for $5000, includes 128K-bytes of RAM, an 8-inch 1250K-byte floppy disk drive, and a monitor. The Model 16 system also includes a Zilog Z-80 microprocessor to run existing Model II software. With the Model 16, Radio Shack became the first major microcomputer manufacturer to introduce a 16-bit microcomputer. Other manufacturers, such as Apple and Xerox, followed suit, so Tandy's initial lead is likely to be very short-lived.

Radio Shack's major weakness is its image. Radio Shack is viewed by many as a hobby-oriented electronics store carrying off-brand merchandise. Its microcomputers have, probably unfairly, been derided by many as being of inferior quality and reliability. While Radio Shack did have early problems with reliability, its products are now more acceptable. These lingering image problems, however, have prevented Radio Shack from gaining a substantial share of the business microcomputer market. Its heaviest sales are concentrated in the home and education markets. Due to the substantial dealer network, Radio Shack is unable to move effectively into the volume corporate accounts marketplace.

Approximately 75 percent of Tandy software for the Model I, III, and color computer is internally produced. Seventy-five percent of all Tandy software is on cartridge, 25 percent on disk, and an insignificant amount on cassette. With the purchase of a color computer, most users also purchase two or three software packages, adding another two or three every six months.

Texas Instruments, Inc.
Personal Computer Division
2301 North University
Lubbock, Texas 79408
(806) 741-3737

Texas Instruments (TI) is the largest semiconductor manufacturer in the world, having won its position in the 1960s by becoming the dominant supplier of semiconductor chips to IBM. TI set a goal of $15 billion in sales by 1990. The company plans to reach that goal is through three major growth areas: semiconductors, distributed processing, and consumer electronics. Technological innovations are the key to this strategy.

In the past year, TI made an all-out effort to make up for previous marketing errors, especially in consumer areas. TI's prior strategy was to educate consumers as to the benefits of TI technology, rather than to produce products that met consumer needs.

TI's 99 personal computer, announced in June 1979, illustrates this. Shipments never picked up and marketing effort was very low. While the product had good graphics and color capabilities, it was widely criticized for its poor keyboard. In addition, adequate software was never developed. The TI 99 utilized the TMS 9900 16-bit microprocessor, which gave the machine the potential of superior processing ability. But no other manufacturer used the TMS 9900 in a microcomputer and, as a result, sufficient independently produced software was never written for the early models.

Rather than encourage third-party software development, TI effectively eliminated it by requiring the purchase of a $30,000 development computer system to write software for the 99/4. Rumblings in the software industry indicate that TI showed little interest in software proposals offered by well-known developers, taking a "do it themselves" attitude.

Soon after, TI sponsored a promotion to encourage the development of software by third parties, including displays directed at customers in computer retail outlets. The promotion spawned a certain amount of controversy, since the software submitted to TI became its property, restricting only resale. Several editorials in microcomputer magazines pointed out that the TI promotion was just a means of acquiring free software ideas.

When the 99 was introduced, it listed for $1150 with the micromainframe unit and a monitor. The product was unbundled in mid-1980 and the mainframe unit was priced at $950. A $200 rebate was also offered within the next three months, with no success. By November 1980, the list price had fallen to $650, still with little success. Finally, in 1981, the early 99 was phased out in favor of the 99/4A selling for $525. The new version had a standardized keyboard. Still, sales remained relatively low, leaving a sour taste in many dealers' and distributors' mouths, who were left holding inventory which was constantly being cut in price. Texas Instruments sold approximately 35,000 units worldwide in 1981, for revenues of $12 million.

In 1982, however, TI employed the discount and marketing strategy it employed with its calculators. The 99/4A was discounted in mid-year to $199, after a $100 rebate, and sold through mass merchandisers such as K-Mart and J.C. Penney. The TI product became the lowest-priced home computer on the market, greatly aiding sales (which numbered over 400,000 units in 1982).

In 1983, TI is aggressively supporting its 99/4A as well as attacking several market segments with new products. In January 1983, TI displayed its 16-bit TI 99/2 console, priced under $100 -- a direct "Sinclair-market" attack. It also introduced the Compact Computer (CC-40), a slightly larger than handheld product with LCD display for the professional market -- a direct "Epson HX20-market" attack. Announced in late January 1982 was the "Pegasus" (internal company product name). The product is to an IBM-PC look-alike with comparable capability at 10 percent less the IBM cost. Pegasus is to also have a high-resolution color video screen for charts and graphs, and the capability of responding to spoken commands. All new products are being supported internally by TI software support (prior to 1982, 83 percent of TI's software was produced internally), but TI is also encouraging third-party software design.

Software Companies

As previously mentioned a vast number of software companies exist here in the United States, from back-room programmers who sell by mail, to larger companies that gross several million in revenue.

In 1982 these software companies earned $61.45 million from the sales of computer home software. The revenue

breakdown according to market segment is in Figure 12. Independent software companies as well as their counterparts internally at hardware facilities both receive the majority of their revenues from entertainment.

Table 21 elaborates further on the 1982 revenue by showing the major software companies and their revenue from computer home software in 1982 (note: several of these companies also supply business software packages; where this occurs the business revenues are factored out). Presently, Sierra On-Line, Sirius, and Broderbund are the top three suppliers, but their market lead is by no means assured in 1983 and beyond, as competition continues to become more fierce.

Automated Simulations/Epyx
1043 Kiel Court
Sunnyvale, CA 94086
(408) 745-0700

Automated Simulations/Epyx is a 100 percent entertainment company which makes 28 games, most which are for Apple and Atari. The company, however, does support Commodore and IBM, whose sales are on the rise, and Radio Shack, whose sales are decreasing.

Revenues in 1982 totaled about $3 million, mainly from its best-selling games of Dragon's Eye and Temple of Apshai.

Broderbund
2 Vista Wood Way
San Rafael, CA 94901
(415) 456-6424

Broderbund is one of the top three software companies (the others being Sierra On-Line Systems, and Sirius Software), with sales revenues in 1982 of about $6 million. Eighty-eight percent of these revenues came from home software sales, divided respectively into 91 percent entertainment, 6 percent education, and 3 percent home management. The remaining percentage of Broderbund's revenues came from general business packages.

In the beginning of 1982, Apple was the primary hardware vendor supported, accounting for 95 percent sales; the other 5 percent was for Radio Shack's TRS-80. In March of that year the TRS-80 line was dropped due to low sales and production of Atari software began. By year's end, Atari sales accounted

FIGURE 12
PERCENTAGE BREAKDOWN OF REVENUES FOR CHS BY INDEPENDENT S/W COMPANIES

73% Entertainment ($45.07 M)

19% Management ($11.16 M)

8% Education ($5.22 M)

Total $61.45 M
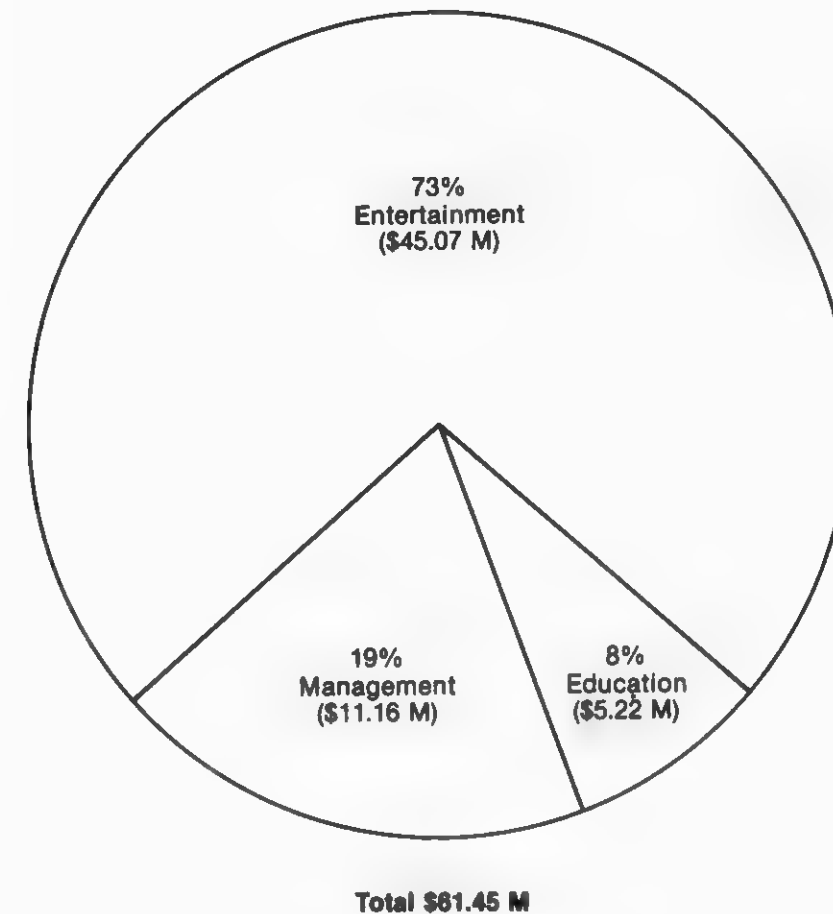
Source: Creative Strategies International

TABLE 21

MAJOR INDEPENDENT SOFTWARE COMPANIES, FOR HOME SOFTWARE PRODUCTS
(Millions of Dollars)

Sierra On-line, Inc.	$10.8
Sirius	8.0
Broderbund	5.25
Continental	4.0
Automated Simulations/EPYX	3.0
Datamost	1.75
Hayden	1.45
Muse	1.2
Sir-Tech	1.0
Lightning	1.0
Edu-Ware	1.0
Softsync	1.0
Spinnaker	.80
LJK	.50
Cavalier	.50
Software Publishing	.40
Howard	.40
Other	20.0
Total	$62.05

Source: Creative Strategies International

for 60 percent revenue while Apple sales had dropped to 40 percent. The company's best-selling programs in 1982 were Apple Panic and Choplifter.

In 1983 Broderbund plans software packages for Apple, Atari, IBM, and the Commodore VIC-20, with an increase in concentration on business and home management packages and a decrease in the entertainment field. Educational packages will continue to be produced, but the number of these seems uncertain.

Cavalier Computer
P.O. Box 2032
Del Mar, CA 92014
(714) 755-8143

The two-year-old entertainment company, Cavalier Computer, had 1982 revenues of $500,000 — double the August 1982 projection.

The company produces five products for Apple (all on disk), and as of June 1982, one product for Atari (disk and cassette). At year-end 1982, shipments were 60 percent Apple, and 40 percent Atari.

Cavalier Computer considers itself the best of the market, due to its quality product and packaging.

Continental Software
11223 Hindry
Los Angeles, CA 90045
(213) 417-8031

Eighty percent of Continental Software products are designed for home use, 100 percent of which is for home management. The company's revenues in 1982 totaled nearly $5 million. The "Home Accountant" is Continental Software's number one product. In 1982, the package was the best-selling home management package for Apple and the fourth or fifth best-selling package overall for the IBM Personal Computer. Continental Software considers the IBM Personal Computer a tremendous factor in its company's success. In mid-1982, sales were 60 percent Apple, 40 percent IBM, but by the year's end, sales evened out to 50 percent each. At year-end 1982, the company was backlogged by only 5000 units. It did not anticipate such sales growth, and did not prepare sufficient documentation.

The second home package of Continental Software, called "First Class Mail," was available in 1982 for Apple until December, when the same program was released for the IBM.

In early 1983, the company plans to introduce a third home management package called "Tax Advantage" and will be available for both Apple and Atari products.

Plans for 1983 include increasing the "Home Accountant" product line to support Osborne, Atari, Radio Shack TRS-80, and the Commodore 64.

Datamost
9748 Cozycroft Avenue
Chatsworth, CA 91311
(213) 366-7160

For calendar year 1982, Datamost produced $2.5 million in revenues. The company revenues breaking down as follows: 60 percent entertainment packages, 35 percent home management, and 5 percent book publishing. In 1983, Datamost hopes to translate existing software (90 percent of 1982 software sales were for Apple) into programs for Atari, TI, Commodore, and other major home computer vendors. The other 10 percent of software sales in 1982 were for IBM; 1983 plans include new packages for the Personal Computer.

Edu-Ware Software
P.O. Box 22222
28035 Dorothy
Agonra, CA 91301
(213) 706-0661

Edu-Ware provides educational and mind-challenging games packages. With $1 million revenues in 1982, it considers itself to be the number one distributor of home educational software in the United States.

Edu-Ware has 17 packages available for the Apple; three of these that have been adapted to Atari. In 1983, the company plans more Atari programs as well as programs for IBM and Commodore.

Hayden Software
600 Suffolk Street
Lowell, MA 01853
(617) 937-0200

Hayden software sales revenues in 1982 were primarily from Apple entertainment packages ($1.3 million). Apple home management packages accounted for another $200,000 revenue with education of primarily Apple products (but also Radio Shack), accounting for the remaining amount of home software sales in 1982. Hayden software also has word processing, a business package called "Pie Writer," and some accounting packages.

Hayden is also a major publisher of books on a wide variety of subjects, including computers. Sales of Hayden books accounted for well over half of all of Hayden's overall revenues in 1982.

Howard Software
8008 Girard Avenue
Suite 310
LaJolla, CA 92037
(619) 454-0121

Howard Software designs and markets home management packages, their best known being "Tax Preparer." In 1982, the company earned $400,000 in revenues from sales of "Tax Preparer," "Real Estate Analyzer," and "Creative Financing" for the Apple II and IBM-PC. In 1983, Howard will continue to produce software for these two vendors, as well as support as-yet-undecided number three. The company is also weighing the possibility of branching out into CP/M-based software.

LJK Enterprises
P.O. Box 10827
St. Louis, MO 63129
(314) 846-6124

LJK had 1982 revenues of about $500,000 from its three home business and management packages called:

* "Letter Perfect" -- word processing
* "Data Perfect" -- inventory
* "Mail Merge"

Seventy percent of revenues in 1982 were from Atari software and 30 percent from Apple.

Lightning Software
P.O. Box 11725
Palo Alto, CA 94306
(415) 856-1855

California-based Lightning Software listed 1982 revenues of $1 million from the sale of its educational package "Master Type."

The disc program is called "Recreational Typing," since it teaches typing as a game and sells retail for under $100. Sales in 1982 were about 70 percent Apple and 30 percent Atari.

In 1983, Lightning plans to release a more professional typing product geared for the adult audience.

Muse Software
347 N. Charles Street
Baltimore, MD 21201
(301) 569-7212

Muse Software's revenue in 1982 was $1.5 million -- 60 percent from entertainment, 20 percent from home management, and the remaining 20 percent from business packages.

The entertainment revenues were all from Apple programs, but the company also plans to support Atari as well as other vendors in 1983. In 1982, Muse had the number one best-selling arcade/adventure game in the United States -- "Castle Wolfenstein." In October 1982, the company introduced an "educational/entertainment" disk called "Know Your Apple." The $35 program described how to use the Apple Computer and is proving to be very successful. In 1983, Muse will concentrate on home education, offering a variety of educational products.

In the home management area, Muse offers a word processing package. Muse views its number one competitor in the word processing area to be Springwriter by Sierra On-Line.

Sierra On-Line, Inc.
36575 Mudge Ranch Road
Coarsegold, CA 93614
(209) 683-6858

Sierra On-Line is the largest independent producer of home software, with 1982 revenues totaling $18 million ($10.8 million of this specifically from home products). The company ships about 28,000 units per month.

Of the $10.8 million in home software revenues, approximately 80 percent is from entertainment software primarily designed for Apple and Atari products. Sierra On-Line has been supplying Apple software for two years and Atari software for less than one year, but each vendor accounts for about the same percentage of entertainment revenues -- 40 percent. Other vendors supplied include IBM, Commodore (VIC-20), Texas Instruments (TI-99), and NEC.

The remainder of Sierra On-Line's home revenues came from home management packages -- screenwriter, database manager, and dictionary.

All packages are presently available only for the Apple, the Screenwriter being the most popular.

In 1983, the company hopes to make every home software package it produces available for all the hardware systems Sierra On-Line supports.

Sirius Software
10364 Rockingham Drive
Sacramento, CA 95827
(916) 366-1195

Sirius Software, another independent leader, produced 100 percent of its $8 million 1982 revenues from entertainment software packages. Up until mid-1982, the company supplied only Apple software, but in June 1982 began producing for Atari, which now accounts for 50 percent sales. Its best-selling packages in 1982 were Gorgon and Beer Run.

Sirius is headed away from Apple and toward the retail markets on Atari, Commodore VIC-20, and Texas Instrument's 99/4A.

The company now produces 100 percent disk software but plans to be 80 percent cartridge, 20 percent disk by the end of 1983, due to the overwhelming amount of software piracy.

Sir-tech Software Inc.
6 Main Street
Ogdensburg, NY 13669
(315) 393-6633

Sir-tech Software shipped about 5000 to 10,000 units of entertainment software per month in 1982 for revenues totaling $1 million. All software was designed for Apple until December 1982, when the company began distributing IBM entertainment packages.

In 1983 Sir-tech plans to support IBM, Commodore 64, and Atari 800 with entertainment software (as well as Apple) and provide some simple business packages for Apple and IBM.

Softsync
P.O. Box 480
Murry Hill Station
New York, N.Y. 10156
(212) 685-2080

Softsync has been in business for 2-1/2 years. In 1982, revenues totaled about $1 million. The software was designed specifically for the Sinclair/Timex ZX-81. Sixty percent of these revenues came from the entertainment and 40 percent from home management. In 1983, the company will add educational packages and expects 1983 sales to break down as follows: 45 percent entertainment, 25 percent home management, and 30 percent education.

In August of 1982, Softsync met its first major competitor in the U.S. Timex/Sinclair software market -- Timex itself. Although Timex licenses about half of its forty software packages from Softsync, thereby contributing to Softsync revenues, it also competes with Softsync at the retail level. Timex has the advantages of representatives, distributors, and a well-known name, while Softsync is mainly a mail order company. However, Softsync considers most of its programs superior to those Timex offers, and better packaged as well.

In 1983, Softsync will begin supplying software for the "Spectrum" -- Sinclair's color, 16K or 48K computer with keyboard, that will retail for about $150. The product will be introduced into the U.S. market in April or May, and Softsync will be ready with software -- some adapted from ZX-81 programs and some designed specifically for the Spectrum.

Software Publishing Company
1901 Landings Drive
Mt. View, CA 94043
(415) 962-8910

Fiscal year-end 1982 (ending in September), produced $4+ million in revenues for Software Publishing Company. Less than 10 percent of these revenues, however, were for home use, mainly on the Apple II.

The company produces home and business packages named:

* PFS File
* PFS Reports
* PFS Graphs

The first two are the more popular programs with installed bases in home and business in mid-1982 of 70,000 units and 55,000 units, respectively.

Recently the company expanded its product line to include the IBM Personal Computer and will be distributed throughout its stores in early 1983. Plans for 1983 also include the support of some of the new TI computers.

Spinnaker Software
215 First Street
Cambridge, MA 02142
(617) 868-4700

Spinnaker Software, with revenues of $800,000 in 1982, produces educational software for Apple, Atari, and IBM. The company has eight programs available and expects to add an additional five or six in 1983. Its best sellers are "Story Machine" and "Snooper Troops."

Spinnaker's "Story Machine" and "Tale Makers" have gained a special significance in the industry, and educational software.

Creative Strategies International (CSI) is a highly diversified market research and consulting firm providing advisory services to the industrial and financial communities in the area of advanced technology. CSI was founded in 1969 to serve the critical need for accurate and reliable information on markets, competitors, and product developments in high-growth industries. CSI is internationally recognized for providing clients with the information needed to remain abreast of developments in advanced technology and the lead time to capitalize on it.

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